

THE knight-kit[®] RF Z-BRIDGE



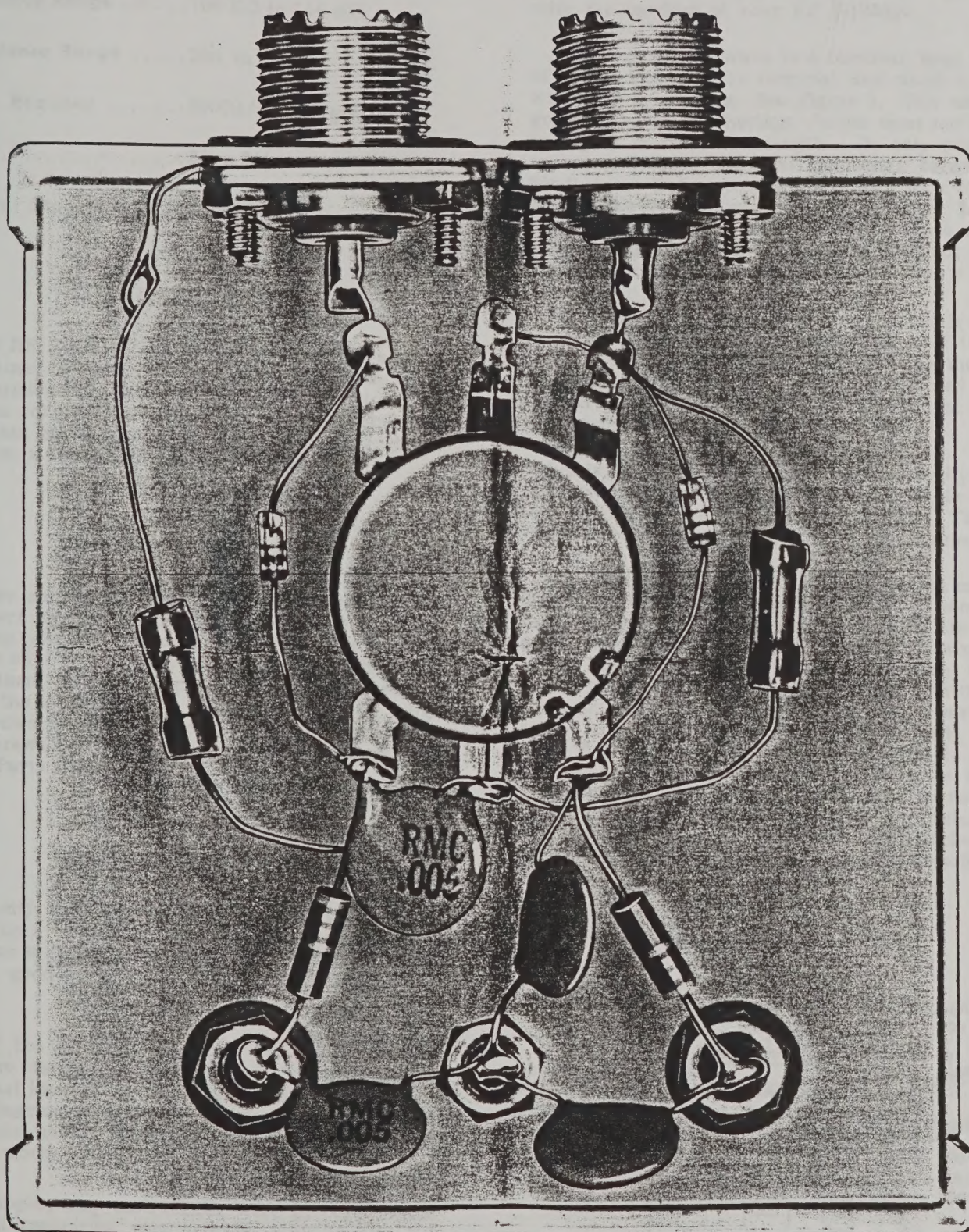
ALLIED RADIO

CORPORATION

100 N. WESTERN AVE. • CHICAGO 80, ILL.

HAYMARKET 1-6800





SPECIFICATIONS

Useful To Measure antenna impedance,
Measure standing-wave
ratio,
Adjust matching networks,
Tune antennas to resonance.

Frequency Range 100 KC to 144 MC

Impedance Range 20 Ω to 400 Ω

Meter Required 5000 Ω /volt or greater

Size 2½ x 3½ x 4"

Approx. Shpg. Weight.. 2 lbs.

INTRODUCTION

This RF Z-Bridge can be used to measure antenna impedance, to tune antennas to resonance, to match transmission lines for minimum SWR, and to adjust antenna couplers and matching networks. These adjustments are necessary for maximum power transfer from a transmitter to an antenna.

CHECKING YOUR KIT

Before starting to build your RF Z-Bridge, check each part against the Parts List on page 11. This will help you become acquainted with each part. If you are unable to identify some of the parts by sight, locate them on the pictorial diagrams. To keep our kits at the lowest possible price, we frequently weigh the hardware rather than count it. It is common for more screws or nuts to be supplied than are specified in the Parts List.

CONSTRUCTION HINTS

The only tools required for building your RF Z-Bridge are: Long-nose pliers, diagonal cutters, medium size screwdriver, setscrew driver, and soldering iron. A good set of tools is listed on the Parts List page.

Study the pictorial diagrams and note how the parts are mounted. These pictorial diagrams show the actual location of all parts and wires. The schematic diagram shows how the parts are connected electrically and is helpful in understanding how the circuits work.

The step-by-step instructions were prepared while a skilled technician was actually building the RF Z-Bridge. We suggest that you check off each step, in the space provided, after you have completed it. Some builders also like to put a pencil mark on the wiring as they complete it.

WIRING AND SOLDERING

Poorly soldered connections are often responsible for poorly functioning or inoperative equipment. A little care taken in wiring and soldering will be well rewarded with a professional looking and a reliable operating instrument. For this reason, we urge you to read the following paragraphs before proceeding with the building of your RF Z-Bridge.

When connecting wires to a terminal, bend the end of the wire around the terminal, and clamp it tightly with long-nose pliers. See Figure 1. This assures a good mechanical connection. Solder must not be used to supply mechanical strength – its only purpose is to assure a good electrical connection between two conductors. Before connecting a wire to a terminal, be sure the terminal and the wire are clean. If necessary, scrape off any foreign material, such as wax, dirt, or enamel with a knife. Be careful not to nick the wire with the knife or it may break when it is bent.

The proper way to connect a component is also illustrated in Figure 1. Pull the end leads of the part being mounted through the holes in the mounting terminals so that the part is tightly mounted. After the part is mounted, bend its leads around the mounting terminals and cut off the excess wire.

Leads on resistors and capacitors are usually longer than needed. These leads should be cut to the proper length when the parts are wired in place. This will result in better operation and neater appearance.

For most electronic work, a soldering iron rated at 60 to 100 watts with a medium-sized tip should be used. To make soldering easier and to get the maximum transfer of heat from the iron to the work, the tip of the soldering iron should be properly tinned. To tin the tip of a soldering iron, clean it with steel wool, or a fine file, until the bright copper surface is seen. Allow the iron to heat until it melts solder when it is held against the tip. Coat the tip of the iron with a thin layer of solder. While the iron is still hot, wipe the tip with a soft rag to remove the excess solder. The tip should now have a "shiny" appearance. When using the iron, occasionally check for proper tinning. Try to keep a thin film of solder on

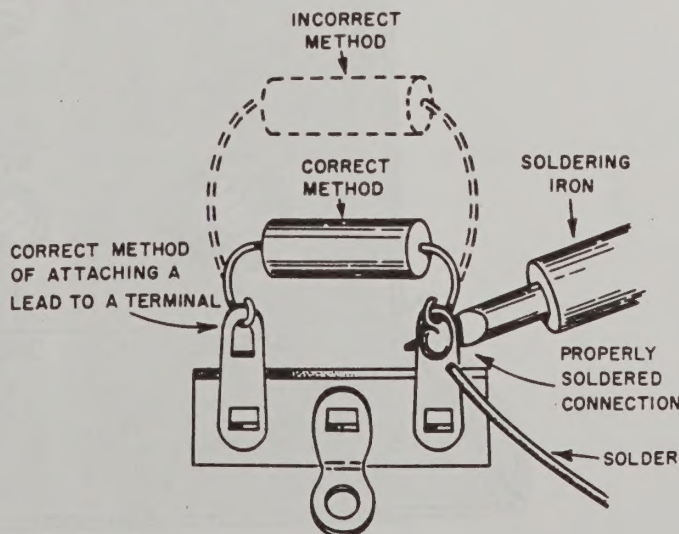


FIGURE 1. HOW TO WIRE AND SOLDER

the tip at all times. Re-tin the iron whenever it becomes covered with a layer of scale.

To solder a connection, hold the tip of the iron against the connection until the connection is hot enough to melt solder. Apply solder to the connection, not to the tip of the iron. Allow just enough solder to flow onto the connection to fill the crevices between the wires and the terminal. Too much solder will result in a poorly soldered connection rather than a better one. Do not disturb the soldered connection until the solder has hardened. If the connection is disturbed, you will have what is known as a "cold solder joint". Cold solder joints are not good elec-

trical connections. If you should accidentally disturb the connection and it hardens with a dull, frosty appearance, re-heat the connection and apply a small amount of solder to it.

USE ONLY ROSIN CORE SOLDER

USE THE ROSIN CORE SOLDER SUPPLIED IN THE KIT. KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX WILL CORRODE AND WILL NOT WORK LONG. SUCH KITS ARE NOT ELIGIBLE FOR REPAIR OR SERVICE.

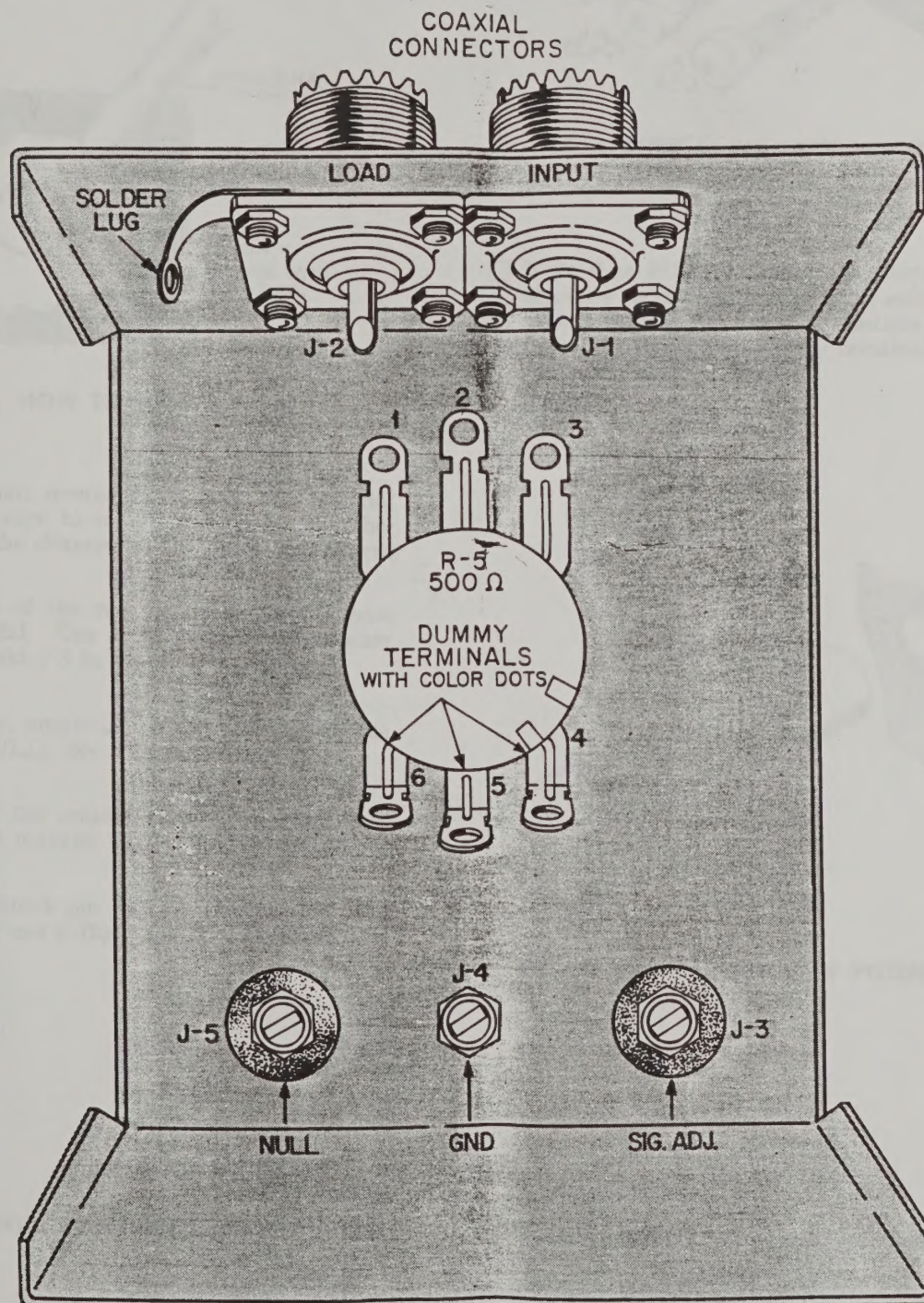


FIGURE 2. PARTS MOUNTING

PARTS MOUNTING

SEE FIGURE 2.

- ☒ On the inside of the chassis, scrape the paint from around the holes used to mount the INPUT and LOAD (J-1 & J-2) coaxial connectors, as shown in Figure 3.
- ☐ From the inside of the chassis, insert the threaded end of J-1, the INPUT coaxial connector, into its mounting hole. Secure J-1 in place with four screws and nuts.

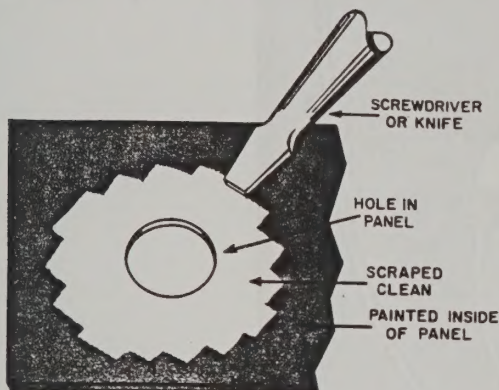


FIGURE 3. HOW TO SCRAPE PAINT

- ☒ In a like manner, mount J-2, the LOAD coaxial connector. Be sure to mount the solder lug, between J-2 and the chassis, on the upper left screw.
- ☐ Mount J-3, one of the red pin jacks, in the hole marked SIG ADJ. Use a fiber shoulder washer and a nut to hold J-3 in place. See Figure 4.
- ☐ In a like manner, mount J-5, a red pin jack, in the hole marked NULL. See Figure 4.
- ☐ On the inside of the chassis, scrape the paint from around the hole marked GND. See Figure 3.
- ☐ Mount J-4, the black pin jack, in the hole marked GND. DO NOT use a fiber shoulder washer. See Figure 4.

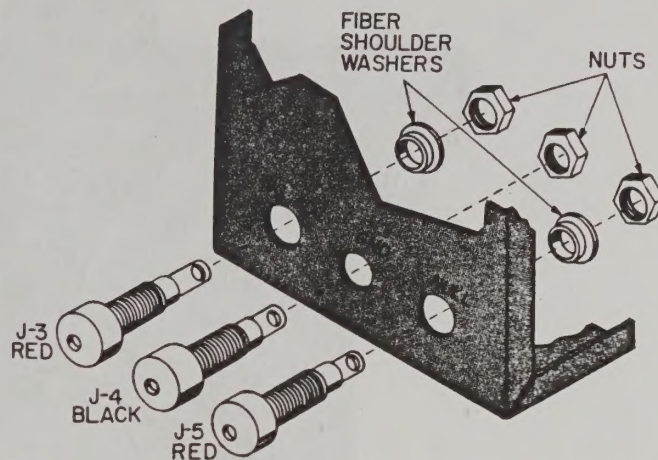


FIGURE 4. PIN JACK MOUNTING

- ☐ Note that R-5, the 500 Ω potentiometer, has three *dummy* terminals marked with *color dots*. Mount R-5 following the assembly details shown in Figure 5. Position the dummy terminals so that they face the three pin jacks.

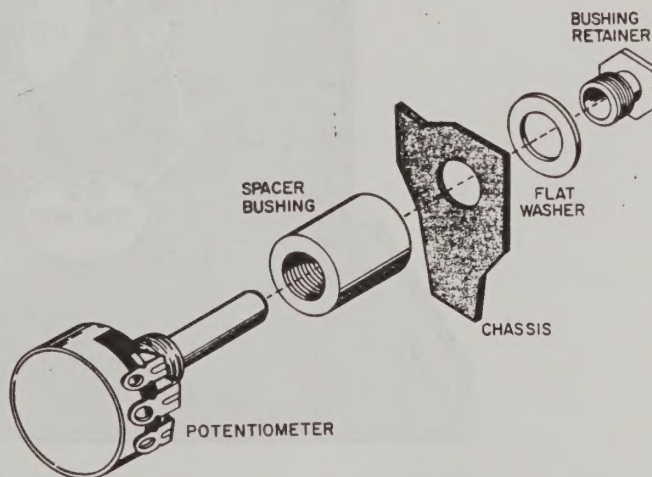


FIGURE 5. MOUNTING THE POTENTIOMETER

WIRING

Remember, use **ONLY THE ROSIN CORE SOLDER** supplied.

SEE FIGURE 6.

- ☐ Bend terminals 1, 2, and 3 of R-5 to a horizontal position.

- ☒ Connect, but do not solder, one lead of R-3, 80 Ω precision resistor, to terminal 5 of R-5. Thread the other lead through terminal 3 of R-5, and then solder it to the terminal on J-1. Do not solder terminal 3 of R-5.

- ☒ Connect, but do not solder, one lead of R-4, 80 Ω

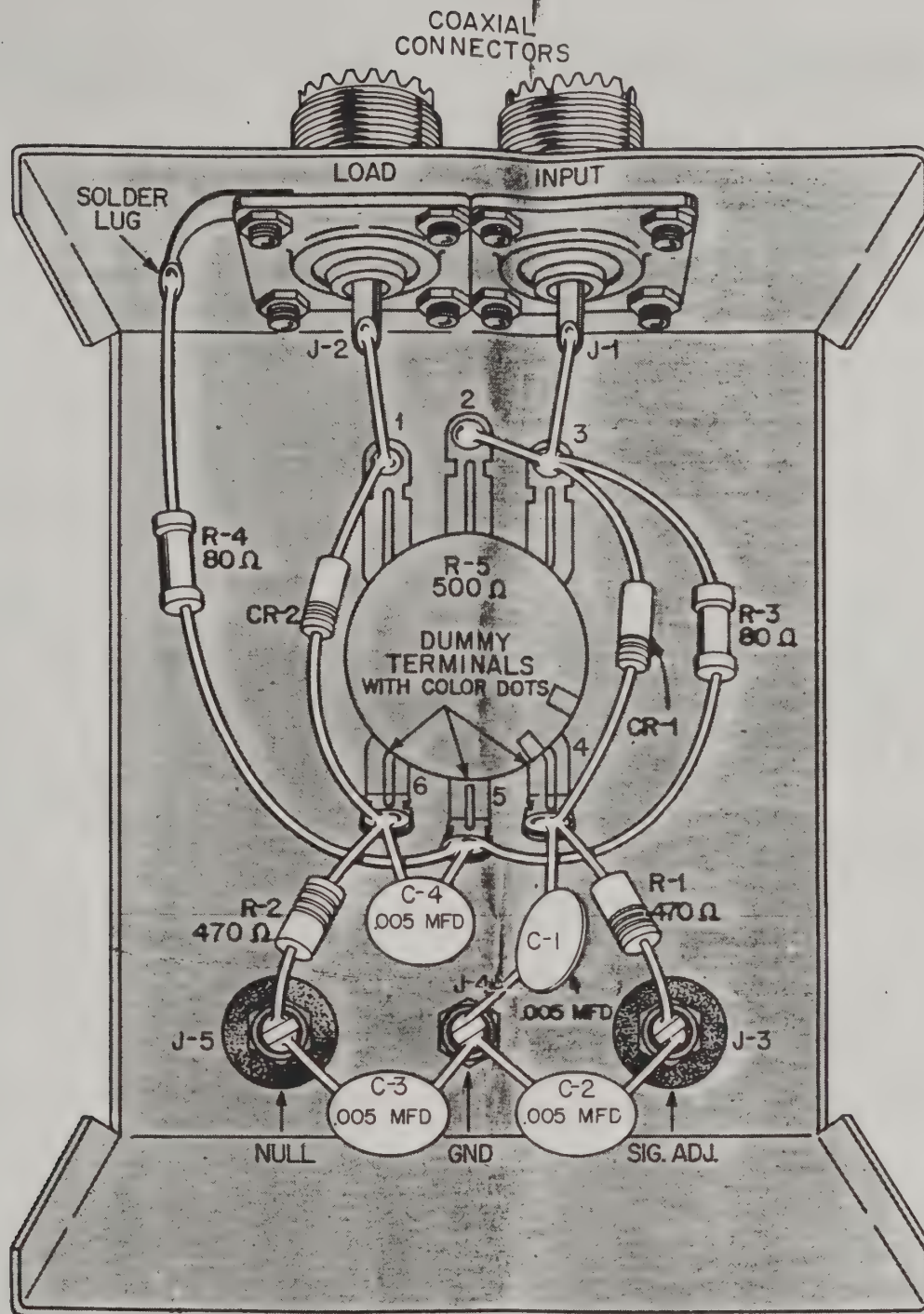


FIGURE 6. WIRING

precision resistor, to terminal 5 of R-5. Solder the other lead to the solder lug mounted under J-2.

- ☐ Notice that one end of CR-1 and CR-2 is marked with **color code bands**. This end may be marked by some manufacturers with a band, a bar, a dot, or a K. To prevent heat damage to the diodes, hold the lead with a pair of long-nose pliers as you solder each lead in place.

- ☐ Connect, but do not solder, the lead from the **marked** end of CR-2 to terminal 6 of R-5. Thread the other lead through terminal 1 of R-5, and then solder it to the terminal on J-2. Solder terminal 1 of R-5.

- ☐ Connect, but do not solder, the lead from the **marked** end of CR-1 to terminal 4 of R-5. Thread the other lead through terminal 3 of R-5, and then solder it to terminal 2 of R-5. Solder terminal 3 of R-5.

- ☐ Connect, but do not solder, one lead of C-3, .005 μ fd (may be marked 5K or 5,000) disc capacitor, to the terminal on J-5. Connect, but do not solder, the other lead to the terminal on J-4.

- ☐ Connect, but do not solder, one lead of C-2, .005 μ fd disc capacitor, to the terminal on J-3. Connect, but do not solder, the other lead to the terminal on J-4.

- ☐ Connect, but do not solder, one lead of C-4, .005 μ fd disc capacitor, to terminal 6 of R-5. Solder the other lead to terminal 5 of R-5.
- ☐ Solder one lead of R-2, 470 Ω resistor (marked with color bands yellow, violet, and brown), to terminal 6 of R-5. Solder the other lead to the terminal on J-5.
- ☐ Connect, but do not solder, one lead of C-1, .005 μ fd disc capacitor, to terminal 4 of R-5. Solder the other lead to the terminal on J-4.

- ☐ Solder one lead of R-1, 470 Ω resistor (yellow, violet, brown), to terminal 4 of R-5. Solder the other lead to the terminal on J-3.
- ☐ Place the cover on the chassis, and secure it in place with two sheet metal screws.

DO NOT ATTEMPT TO USE YOUR RF Z-BRIDGE UNTIL YOU HAVE READ THE FOLLOWING INSTRUCTIONS ON HOW TO USE YOUR RF Z-BRIDGE. IMPROPER OPERATION MAY CAUSE PERMANENT DAMAGE TO YOUR Z-BRIDGE.

HOW TO USE YOUR RF Z-BRIDGE

OPERATING NOTES

Since the RF Z-Bridge requires only a very low power level to operate it, it may be necessary to couple it to a low-power driver stage rather than the final amplifier. The plate voltage and drive to the final amplifier can be reduced if it is desired to use the final amplifier as a source of power. Always connect a suitable dummy load to the transmitter when using the Z-Bridge. Be sure the Z-Bridge coupling and the dummy load coupling to the transmitter remains constant. A grid-dip meter with sufficient output can be used as a source of power to operate the Z-Bridge.

The transmitter should be free from harmonics and other spurious components. Otherwise, a good null may not be obtained. If you encounter difficulty in obtaining a good null, check the transmitter with a wavemeter to insure that only the desired frequency is present.

For additional information refer to The Radio Amateur's Handbook.

CAUTION

DO NOT EXCEED 12.5 VOLTS (MEASURED AT THE SIG. ADJ. JACK) INPUT TO YOUR RF Z-BRIDGE. EXCESSIVE VOLTAGE WILL DAMAGE THE PRECISION RESISTORS AND THE DIODES. ALWAYS DISCONNECT THE Z-BRIDGE FROM THE TRANSMITTER AS SOON AS THE ADJUSTMENTS OR MEASUREMENTS HAVE BEEN COMPLETED.

4. Connect a suitable dummy load to the output of your transmitter.
5. Loosely couple the INPUT of the Z-Bridge to the transmitter. Only a very low power level is required to operate the Z-Bridge. A one or two-turn loop, on the end of a coaxial feed line placed near the transmitter's tank coil, will give sufficient pick-up to operate the Z-Bridge. See Figure 7. The feed line can be connected directly to a pi-type output circuit. Set the coupling to minimum.
6. Adjust the control on the Z-Bridge for best possible null (zero reading). For a more accurate indication, as the null is approached, set the meter to a lower scale.
7. Place the knob on the shaft of the control so that the line on the knob indicates 72 on the scale of the Z-Bridge. Tighten the setscrew. Your RF Z-Bridge is now adjusted for accurate measurements. Disconnect the calibrating resistor and save it for future calibrating of the Z-Bridge.

HOW TO ADJUST MATCHING NETWORKS

SEE FIGURE 7.

HOW TO CALIBRATE THE RF Z-BRIDGE

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Temporarily connect one lead of the 72 Ω calibrating resistor to the center terminal of the LOAD coaxial connector (J-2). Connect the other lead to the outer shell of the connector.
3. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the Z-Bridge. Set the meter to a DC range that has 2.5 or 5 volts full scale.
Note: If a VTVM is used, direct pick-up of RF by the VTVM may affect the readings.

1. Set the control of the RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to a DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.
4. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. The frequency of the transmitter should be close to the resonant frequency of the antenna. Only a very low power level is required to operate the RF Z-Bridge. A one or two turn loop on the end of a coaxial feed line, placed near the transmitter's tank coil, will give sufficient pick-up to operate the Z-Bridge. The feed line can be connected directly to a pi-type output circuit. Set the coupling to minimum.

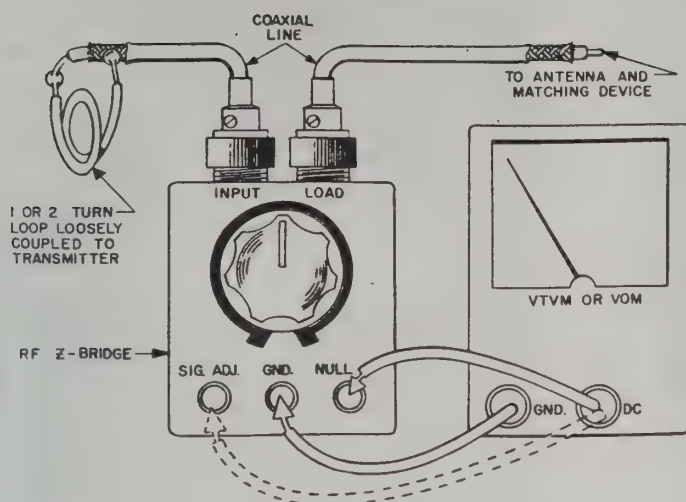


FIGURE 7. TYPICAL SET-UP USING COAXIAL CABLE

HOW TO MEASURE STANDING-WAVE RATIO

SEE FIGURE 7.

1. Set the control of your RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to the DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.
4. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Measure the voltage at the SIG ADJ jack with the meter. Make a note of this reading.
7. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
8. Connect the load to be measured to the LOAD connector on the RF Z-Bridge. If a matching network is used, adjust it for best null. Best results are obtained when the load is resonant at the transmitter frequency.
9. Adjust the coupling to the transmitter until the voltage at the SIG ADJ jack reads the same as the reading taken in step 6.
10. Read the voltage at the NULL jack. Determine this reading relative to full scale deflection. If you are using 5 volts full scale deflection, a null reading of 2 volts is .4 of full scale. Meter reading relative to full scale = $\frac{\text{null reading}}{\text{full scale}} = \frac{2}{5} = .4$.
11. Read the SWR from the chart in Figure 8. A meter reading of .4 relative to full scale deflection is a 2.3 to 1 SWR.

ADJUSTING THE ANTENNA TO RESONANCE

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to the DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.
4. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. The transmitter must be operating at the desired frequency. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
7. Adjust the matching network (if used) and the length of the antenna for best null. A resonant antenna is purely resistive. Best nulls are obtained with purely resistive loads. The antenna is now resonant at the frequency of the transmitter. Beam antennas should be adjusted with the director 5% shorter and the reflector 5% longer than the driven element.

IMPEDANCE MEASUREMENT

SEE FIGURE 7.

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. Use a suitable dummy load. The transmitter and the load should be resonant to the same frequency. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
3. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks. Set the meter to a DC range that has 2.5 or 5 volts full scale.

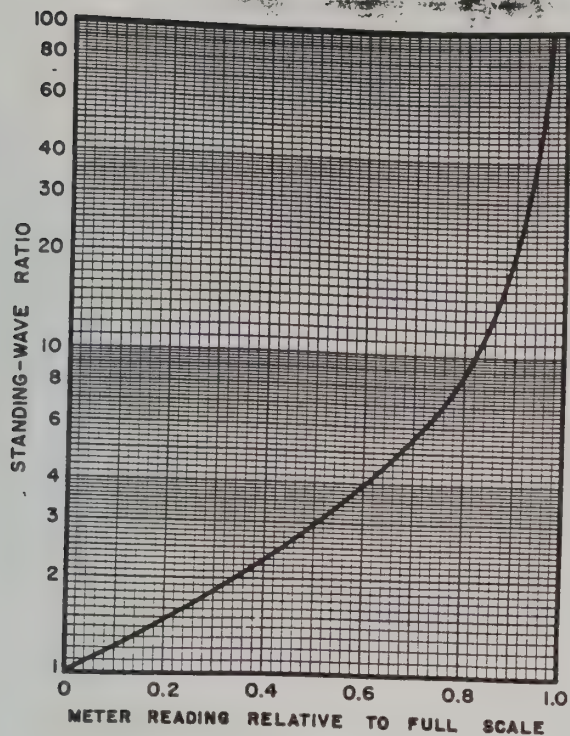


FIGURE 8. STANDING-WAVE RATIO CHART

4. Adjust the coupling to the transmitter for full scale deflection.
5. Connect the load to be measured to the LOAD connector on the RF Z-Bridge. Note: The load can be an antenna, a capacitor, a resistor, or a choke coil. The impedance of any one of these items can be measured at a particular frequency provided the impedance is within the range of 20 to 400 ohms.
6. Adjust the control on the RF Z-Bridge for minimum reading or null on the meter. If the load is purely resistive, a good null will be obtained. But, the more reactive the load, the poorer the null.
7. Read the impedance of the load directly from the scale on the RF Z-Bridge.

HOW TO OBTAIN THE BEST MATCH AND MEASURE THE STANDING-WAVE RATIO USING PARALLEL LINES

SEE FIGURE 9.

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to a DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.

4. Loosely couple the INPUT of the RF Z-Bridge to a transmitter. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
7. Measure the voltage at the SIG ADJ jack with the meter. Make a note of this reading.
8. Connect the load through a suitable antenna coupler to the LOAD connector. Best results are obtained when the load and the transmitter are resonant at the same frequency.
9. Adjust Ca, Cb, and the taps on the antenna coupler (See Figure 9) until the best possible null is obtained. This adjustment provides the best match between the transmission line and the transmitter. To get the broadest frequency response, try to obtain the null with Ca near maximum and with the taps on Lb as far apart as possible. Keep the taps equidistant from the center.
10. Adjust the coupling to the transmitter until the voltage at the SIG ADJ jack reads the same as the reading taken in step 7.
11. Read the voltage at the NULL jack. Determine this reading relative to full scale deflection. If you are using 5 volts full scale deflection, a null reading of 2 volts is .4 relative to full scale. Meter reading relative to full scale = $\frac{\text{null reading}}{\text{full scale}} = \frac{2}{5} = .4$.
12. Read the SWR from the chart shown in Figure 8.
13. If the SWR of 1-to-1 cannot be obtained, the SWR of the transmission line is high, and the length of the line is unfavorable. A SWR of 3-to-1 or less is usually satisfactory.

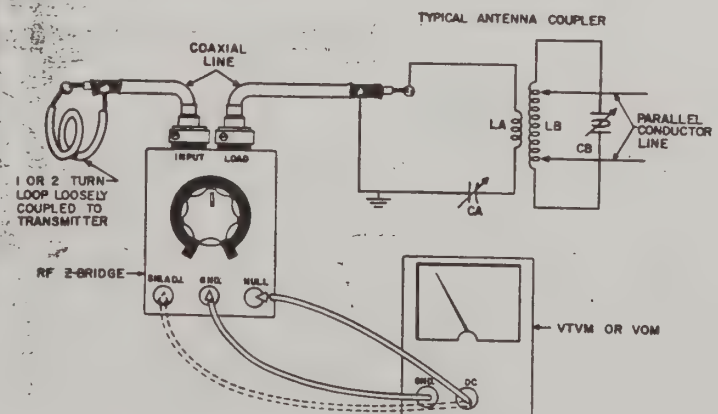


FIGURE 9. TYPICAL SET-UP USING AN ANTENNA COUPLER

HOW TO MEASURE IMPEDANCE USING PARALLEL LINES

SEE FIGURE 10.

1. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks. Set the meter to a DC range that has 2.5 or 5 volts full scale.
3. Adjust the coupling to the transmitter for full scale deflection.
4. Connect the load to be measured through a balun (a device for matching balanced to unbalanced) to the load connector on the RF Z-Bridge.
5. Adjust the control on the RF Z-Bridge for minimum reading or null on the meter. If the load is purely resistive, a good null will be obtained. But,

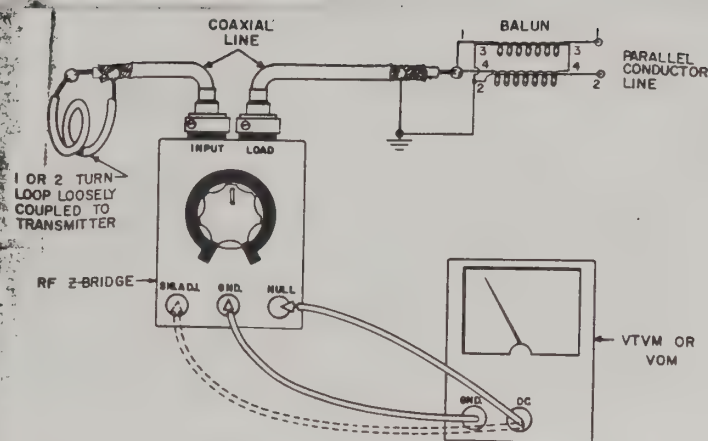


FIGURE 10. TYPICAL SET-UP USING A BALUN

as the reactive component of the load increases the null will be less prominent.

6. Multiply the reading on the RF Z-Bridge by 4 to get the impedance of the load. This is necessary because a balun usually provides a 4-to-1 step-down ratio from balanced to unbalanced.

HOW IT WORKS

The RF Z-Bridge circuit consists of a simple resistance bridge and a diode detector. The bridge is made up of resistors R-3, R-4, R-5, and the load.

Resistors R-3 and R-4 are of identical value so that when the load is equal to R-5, the bridge will be balanced and there will be no voltage applied to CR-2. The resistance of the load will be indicated on the scale. However, if the transmission line does not match the load, the reflected voltage will not see the bridge, and will be indicated by a voltmeter connected

to the NULL jack. This characteristic is used to measure standing-wave ratios of transmission lines.

The crystal diode CR-2 rectifies the RF voltage so that it can be indicated by a DC voltmeter. This rectified voltage is filtered by R-2 and C-3. C-4 is a DC blocking capacitor.

To measure the input signal, a rectifier and filter network comprised of CR-1, R-1, C-1, and C-2 are provided.

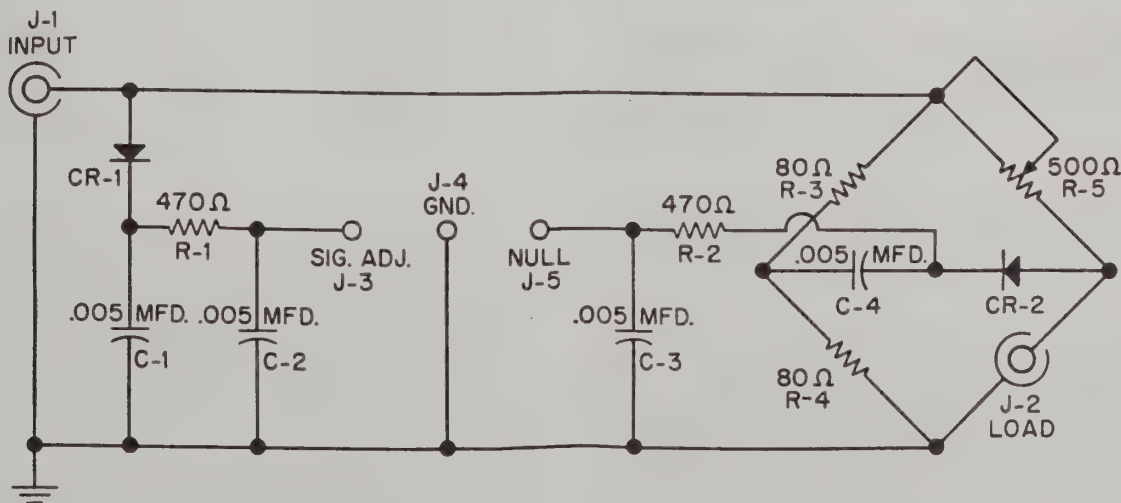


FIGURE 11. SCHEMATIC DIAGRAM

PARTS LIST FOR THE RF Z-BRIDGE

Symbol Number	Description	Part No.
C-1	Capacitor, .005 μ fd disc.....	16L362
C-2	Capacitor, .005 μ fd disc.....	16L362
C-3	Capacitor, .005 μ fd disc.....	16L362
C-4	Capacitor, .005 μ fd disc.....	16L362
CR-1	Diode, crystal.....	630004
CR-2	Diode, crystal.....	630004
J-1	Connector, coaxial.....	40H352
J-2	Connector, coaxial.....	40H352
J-3	Jack, red: with mtg. hardware.....	41H110
J-4	Jack, black: with mtg. hardware.....	41H115
J-5	Jack, red: with mtg. hardware.....	41H110

NOTE: When ordering resistors, give complete description and part number.

R-1	Resistor, 470 Ω , $\frac{1}{2}$ W.....	2MM040
R-2	Resistor, 470 Ω , $\frac{1}{2}$ W.....	2MM040
R-3	Resistor, 80 Ω , $\frac{1}{2}$ W, 1%.....	340800
R-4	Resistor, 80 Ω , $\frac{1}{2}$ W, 1%.....	340800
R-5	Potentiometer, 500 Ω	390400
	Resistor, 72 Ω , $\frac{1}{2}$ W, 1%.....	340720

* Subject To Change.

Description	Qty.	Part No.
Bushing, polystyrene.....	1.....	870023
Bushing, retainer.....	1.....	470068
Chart, SWR.....	1.....	750070
Cover, front.....	1.....	462244
Cover, rear.....	1.....	463110
Knob.....	1.....	761304
Manual.....	1.....	750069
Nut, hex, #4-36.....	8.....	570230
Screw, machine: #4-36 x $\frac{3}{8}$	8.....	560234
Screw, self-tapping: 4 x $\frac{1}{4}$	2.....	562232
Solder, 6".....	1.....	46N900
Solder lug, #8.....	1.....	553002
Washer, flat metal.....	1.....	580702

TOOLS YOU MAY NEED

Stock No.	Description
46N852.....	Soldering iron
50N132.....	6" long-nose pliers
50N133.....	5" diagonal cutters
45N378.....	6" screwdriver

ALLIED'S GUARANTEE ON KNIGHT KITS

The designs and components selected for KNIGHT kits represent over a quarter of a century of experience in kit development. KNIGHT kits are easy to assemble even for a beginner. The instructions are complete, panels are drilled, the chassis is punched and formed, and every part is included as listed.

Allied extends these firm guarantees on KNIGHT kits:

We guarantee that the circuits in all KNIGHT kits have been carefully engineered and tested.

We guarantee that only high-quality components are supplied. All parts are covered by the standard RETMA 90-day warranty. Any faulty components will be replaced prepaid and without charge if reported to us within the warranty period. We reserve the right to request the return of defective parts.

If your kit was shipped by parcel post and is received in a damaged condition, please write us at once describing the state in which the shipment was received. If your kit was part of a Railway Express shipment that was damaged in transit, please notify the Railway Express agent at once and then write us.

The efficiently engineered KNIGHT kits are moderately priced. When you buy a KNIGHT kit you get the best in design, quality, and value. Recommend KNIGHT kits to your friends.

ALLIED'S SERVICE FACILITIES

If the kit does not operate properly, we recommend the following:

Please write our Kit Department giving the stock number and date of purchase of the kit. Also, describe fully what appears to be wrong. Details as to which controls or sections of the circuit do not function properly will help us analyze the problem. We may be able to determine a wiring error or a defective part.

This wired KNIGHT kit may be returned for inspection within one year after purchase for a special service charge of \$2.00. Parts within the standard RETMA 90-day warranty period will be replaced without charge for the parts. A charge will be made for parts damaged in construction or because of a wiring error, or for parts which are beyond the 90-day warranty period. After the one year period, service charges are based on the length of time required to repair the unit plus the cost of any new parts that may be needed.

PLEASE NOTE: KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX ARE NOT ELIGIBLE FOR REPAIR OR SERVICE AND WILL HAVE TO BE RETURNED NOT REPAIRED AT YOUR EXPENSE.

Allied's service facilities are primarily for inspection and trouble-shooting. Kits not completely wired, which require extensive work, will be returned collect with a letter of explanation.

If you return this kit, pack it well. To prevent damage in shipment, use a large enough carton so that cushioning material can be placed around the unit. Cushion it well and tightly. Mark the carton, "FRAGILE — DELICATE ELECTRONIC INSTRUMENT." Send the kit prepaid and insured. We will return the repaired kit to you C.O.D. as soon as repairs are completed. If you wish to save C.O.D. fees, your advance remittance may be enclosed to cover the standard repair charges plus transportation costs. Any excess money will be refunded.

Other Famous **knight-kits** For the **AMATEUR**



knight-kit
50-WATT TRANSMITTER
83YX255

Whether you're looking for a low-cost transmitter to put you "on-the-air"; or, a dependable stand-by rig—you'll do well to check through all of the many desirable features of the KNIGHT-KIT transmitter.

The KNIGHT-KIT transmitter is a complete, self-contained, bandswitching cw transmitter kit that can be operated crystal controlled or with external vfo.

With all parts, tubes, pre-cut wire, solder, and step-by-step instructions.



knight-kit
VFO
83Y725

The KNIGHT-KIT VFO offers high-quality performance at incomparably low cost. Look over its array of outstanding features and you'll see that it includes everything desirable in vfo design. It's a completed vfo with built-in transformer-type power supply. Features ex-

trremely high stability, excellent oscillator keying characteristic for fast break-in operation, highly effective tvr suppression, easy tuning and ultra-compact construction.

Exceptional frequency stability is assured by careful circuit design and rigid mechanical construction. Drift free, series-tuned Clapp oscillator employs 1% silver mica capacitors. Oscillator tank coil is wound on heavy ceramic form. Excellent voltage regulation maintains stable output, unaffected by changes in line voltage. Rugged mechanical construction—oscillator chassis is flange-welded for rigidity; bandswitch is heavy ceramic. Has Calibrate-Standby-Transmit switch for "no-swish" tuning. Extra switch contacts are connected to a terminal strip on rear of chassis for control of external equipment.

Complete with all parts, tubes, pre-cut wire, solder, and step-by-step instructions.

SPECIFICATIONS

Output Frequencies: 3.5 — 4 mc
7.0 — 7.3 mc
14.0 — 14.3 mc
21.0 — 21.5 mc
27.0 — 27.2 mc
28.0 — 29.7 mc

Power Input To Final Amplifier: 50 watts minimum on all bands.

Frequency Control: Quartz crystal or external vfo.

Output Circuit: Pi-network, capable of matching unbalanced loads between 50 and 1200 ohms. Will tune out large amounts of reactance. Connection to the output is through an SO-239 type coaxial connector.

Tubes: 6AG7 crystal oscillator-multiplier (buffer-multiplier when vfo used), 807 power amplifier, 5U4G rectifier.

Modulation: Provision is made for the connection of an external modulator.

VFO Operation: The KNIGHT 50-Watt Amateur Transmitter may be controlled by any vfo supplying 8 to 10 volts across 22,000 ohms, and delivering output in the 160, 80, or 40 meter bands. The KNIGHT VFO is ideally suited.

TVI Reduction: The transmitter is completely shielded by its cabinet, with firm metal-to-metal seals provided at all metal junctions. The copper finished chassis is well bonded to both front and rear of the cabinet, thus assuring minimum harmonic radiation. Filtering and bypassing of AC and keying leads is provided, and generous bypassing of the meter and heater circuits is included.

Size: 10½ x 8½ x 8¼".

Shipping Weight: 18 lbs.

SPECIFICATIONS

Frequency Coverage: 80, 40, 20, 15, 11, and 10 meter bands.

RF Output: 40 volt output on 80 meters; 20 volt output on 40 meters. Dial calibrated on all bands.

Tubes: 6BH6 Clapp oscillator, 6BH6 buffer-doubler, 6X4 rectifier, and OA2 voltage regulator.

Power Source: 110 to 120 volts, 50 to 60 cycles.

Size: 8¾ x 6 x 6".

Shipping Weight: 8 lbs.

THE knight-kit[®] RF Z-BRIDGE

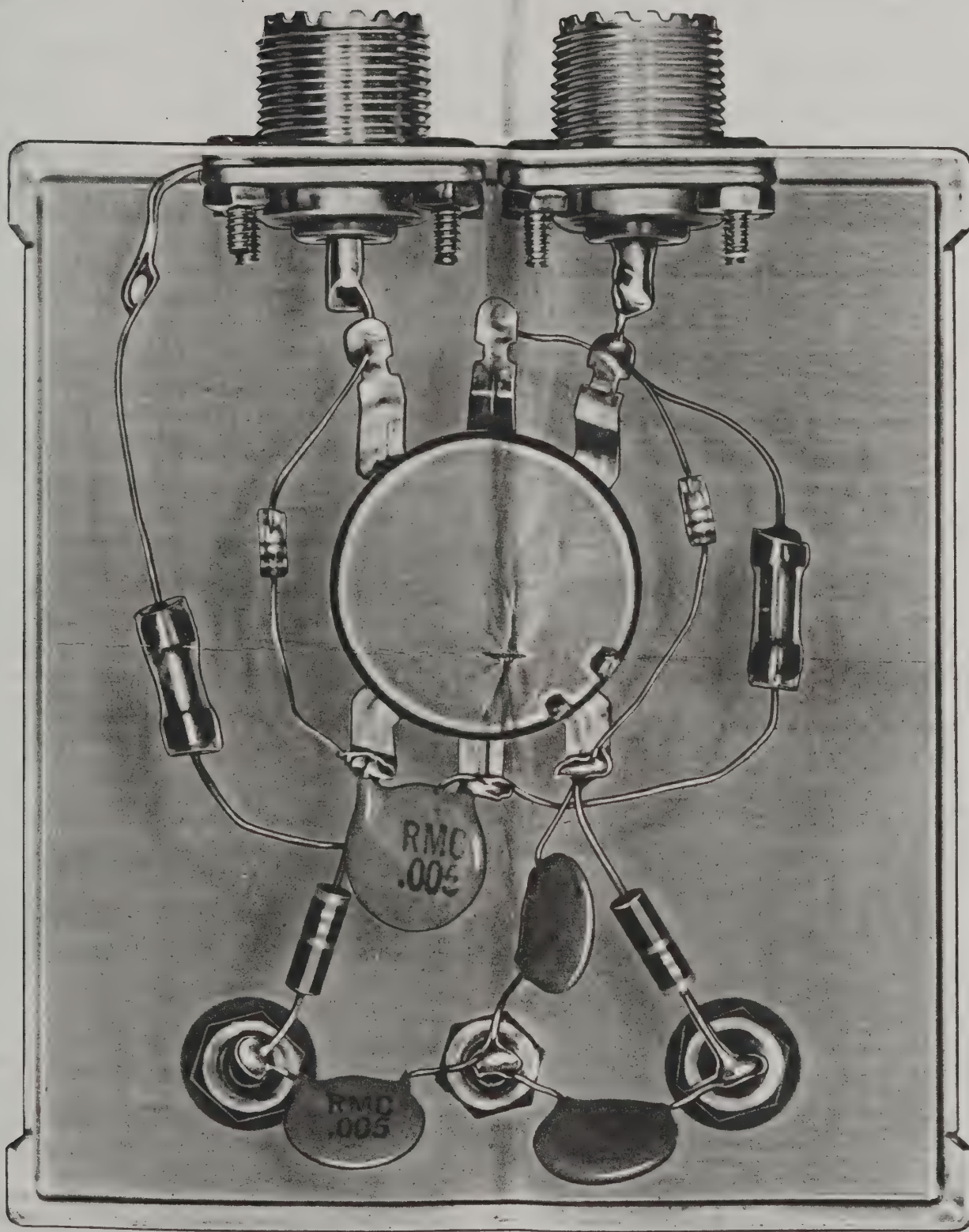


ALLIED RADIO

CORPORATION



100 N. WESTERN AVE. • CHICAGO 80, ILL. HAYMARKET 1-6800



SPECIFICATIONS

Useful To Measure antenna impedance,
Measure standing-wave
ratio,
Adjust matching networks,
Tune antennas to resonance.

Frequency Range 100 KC to 144 MC

Impedance Range 20Ω to 400Ω

Meter Required $5000\Omega/\text{volt}$ or greater

Size $2\frac{1}{2} \times 3\frac{1}{2} \times 4"$

Approx. Shpg. Weight. .2 lbs.

INTRODUCTION

This RF Z-Bridge can be used to measure antenna impedance, to tune antennas to resonance, to match transmission lines for minimum SWR, and to adjust antenna couplers and matching networks. These adjustments are necessary for maximum power transfer from a transmitter to an antenna.

CHECKING YOUR KIT

Before starting to build your RF Z-Bridge, check each part against the Parts List on page 11. This will help you become acquainted with each part. If you are unable to identify some of the parts by sight, locate them on the pictorial diagrams. To keep our kits at the lowest possible price, we frequently weigh the hardware rather than count it. It is common for more screws or nuts to be supplied than are specified in the Parts List.

CONSTRUCTION HINTS

The only tools required for building your RF Z-Bridge are: Long-nose pliers, diagonal cutters, medium size screwdriver, setscrew driver, and soldering iron. A good set of tools is listed on the Parts List page.

Study the pictorial diagrams and note how the parts are mounted. These pictorial diagrams show the actual location of all parts and wires. The schematic diagram shows how the parts are connected electrically and is helpful in understanding how the circuits work.

The step-by-step instructions were prepared while a skilled technician was actually building the RF Z-Bridge. We suggest that you check off each step, in the space provided, after you have completed it. Some builders also like to put a pencil mark on the wiring as they complete it.

WIRING AND SOLDERING

Poorly soldered connections are often responsible for poorly functioning or inoperative equipment. A little care taken in wiring and soldering will be well rewarded with a professional looking and a reliable operating instrument. For this reason, we urge you to read the following paragraphs before proceeding with the building of your RF Z-Bridge.

When connecting wires to a terminal, bend the end of the wire around the terminal, and clamp it tightly with long-nose pliers. See Figure 1. This assures a good mechanical connection. Solder must not be used to supply mechanical strength – its only purpose is to assure a good electrical connection between two conductors. Before connecting a wire to a terminal, be sure the terminal and the wire are clean. If necessary, scrape off any foreign material, such as wax, dirt, or enamel with a knife. Be careful not to nick the wire with the knife or it may break when it is bent.

The proper way to connect a component is also illustrated in Figure 1. Pull the end leads of the part being mounted through the holes in the mounting terminals so that the part is tightly mounted. After the part is mounted, bend its leads around the mounting terminals and cut off the excess wire.

Leads on resistors and capacitors are usually longer than needed. These leads should be cut to the proper length when the parts are wired in place. This will result in better operation and neater appearance.

For most electronic work, a soldering iron rated at 60 to 100 watts with a medium-sized tip should be used. To make soldering easier and to get the maximum transfer of heat from the iron to the work, the tip of the soldering iron should be properly tinned. To tin the tip of a soldering iron, clean it with steel wool, or a fine file, until the bright copper surface is seen. Allow the iron to heat until it melts solder when it is held against the tip. Coat the tip of the iron with a thin layer of solder. While the iron is still hot, wipe the tip with a soft rag to remove the excess solder. The tip should now have a "shiny" appearance. When using the iron, occasionally check for proper tinning. Try to keep a thin film of solder on

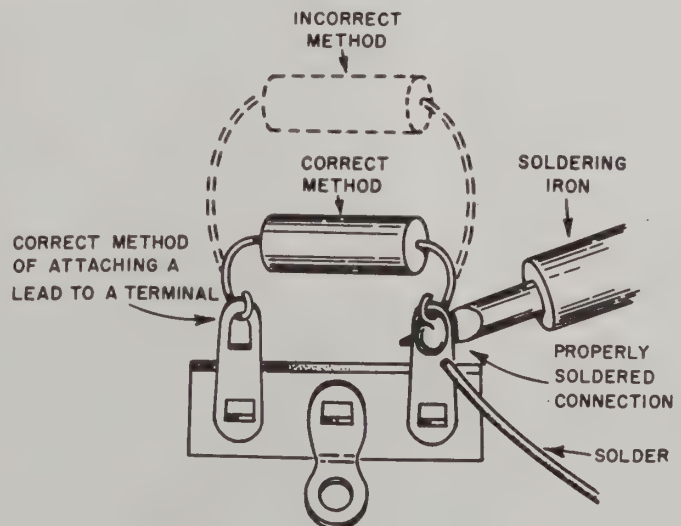


FIGURE 1. HOW TO WIRE AND SOLDER

the tip at all times. Re-tin the iron whenever it becomes covered with a layer of scale.

To solder a connection, hold the tip of the iron against the connection until the connection is hot enough to melt solder. Apply solder to the connection, not to the tip of the iron. Allow just enough solder to flow onto the connection to fill the crevices between the wires and the terminal. Too much solder will result in a poorly soldered connection rather than a better one. Do not disturb the soldered connection until the solder has hardened. If the connection is disturbed, you will have what is known as a "cold solder joint". Cold solder joints are not good elec-

trical connections. If you should accidentally disturb the connection and it hardens with a dull, frosty appearance, re-heat the connection and apply a small amount of solder to it.

USE ONLY ROSIN CORE SOLDER

USE THE ROSIN CORE SOLDER SUPPLIED IN THE KIT. KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX WILL CORRODE AND WILL NOT WORK LONG. SUCH KITS ARE NOT ELIGIBLE FOR REPAIR OR SERVICE.

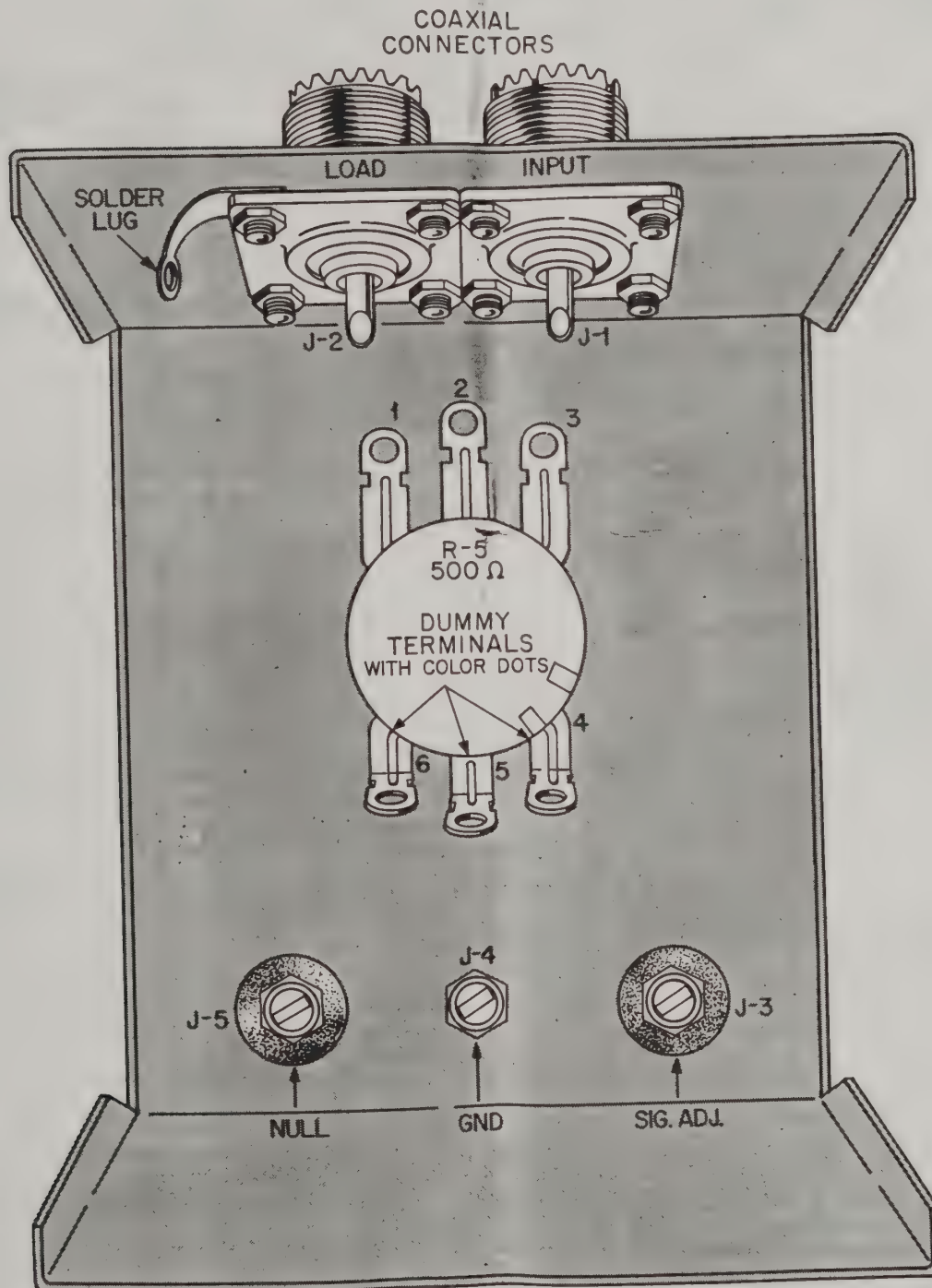


FIGURE 2. PARTS MOUNTING

PARTS MOUNTING

SEE FIGURE 2.

- ☒ On the inside of the chassis, scrape the paint from around the holes used to mount the INPUT and LOAD (J-1 & J-2) coaxial connectors, as shown in Figure 3.
- ☒ From the inside of the chassis, insert the threaded end of J-1, the INPUT coaxial connector, into its mounting hole. Secure J-1 in place with four screws and nuts.

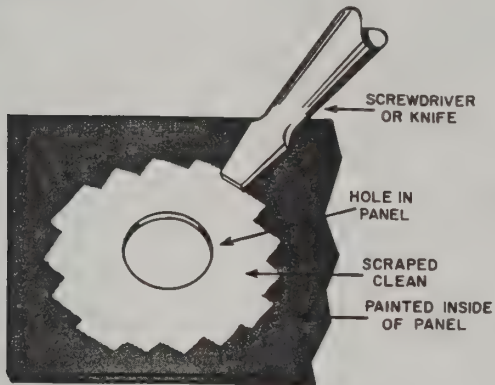


FIGURE 3. HOW TO SCRAPE PAINT

- ☒ In a like manner, mount J-2, the LOAD coaxial connector. Be sure to mount the solder lug, between J-2 and the chassis, on the upper left screw.
- ☒ Mount J-3, one of the red pin jacks, in the hole marked SIG ADJ. Use a fiber shoulder washer and a nut to hold J-3 in place. See Figure 4.
- ☒ In a like manner, mount J-5, a red pin jack, in the hole marked NULL. See Figure 4.
- ☒ On the inside of the chassis, scrape the paint from around the hole marked GND. See Figure 3.
- ☒ Mount J-4, the black pin jack, in the hole marked GND. DO NOT use a fiber shoulder washer. See Figure 4.

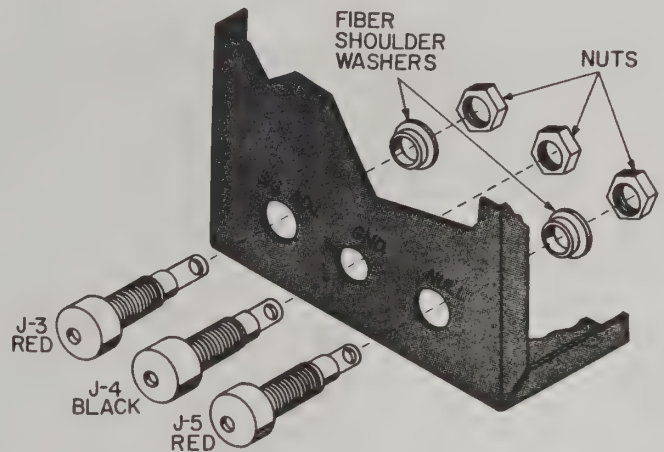


FIGURE 4. PIN JACK MOUNTING

- ☐ Note that R-5, the 500 Ω potentiometer, has three *dummy* terminals marked with *color dots*. Mount R-5 following the assembly details shown in Figure 5. Position the dummy terminals so that they face the three pin jacks.

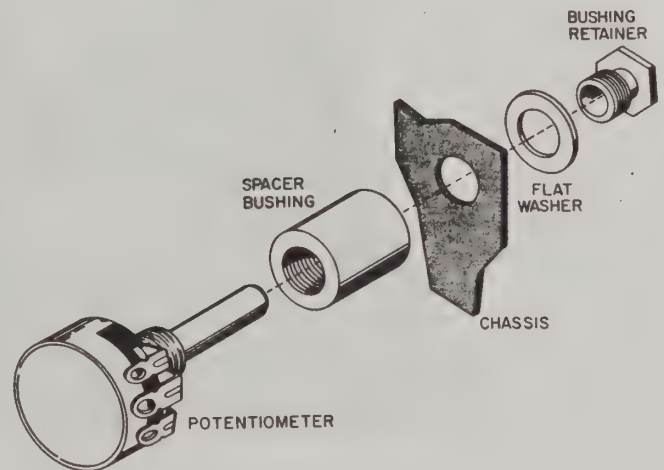


FIGURE 5. MOUNTING THE POTENTIOMETER

WIRING

Remember, use **ONLY THE ROSIN CORE SOLDER** supplied.

SEE FIGURE 6.

- ☐ Bend terminals 1, 2, and 3 of R-5 to a horizontal position.

- ☒ Connect, but do not solder, one lead of R-3, 80 Ω precision resistor, to terminal 5 of R-5. Thread the other lead through terminal 3 of R-5, and then solder it to the terminal on J-1. Do not solder terminal 3 of R-5.

- ☒ Connect, but do not solder, one lead of R-4, 80 Ω

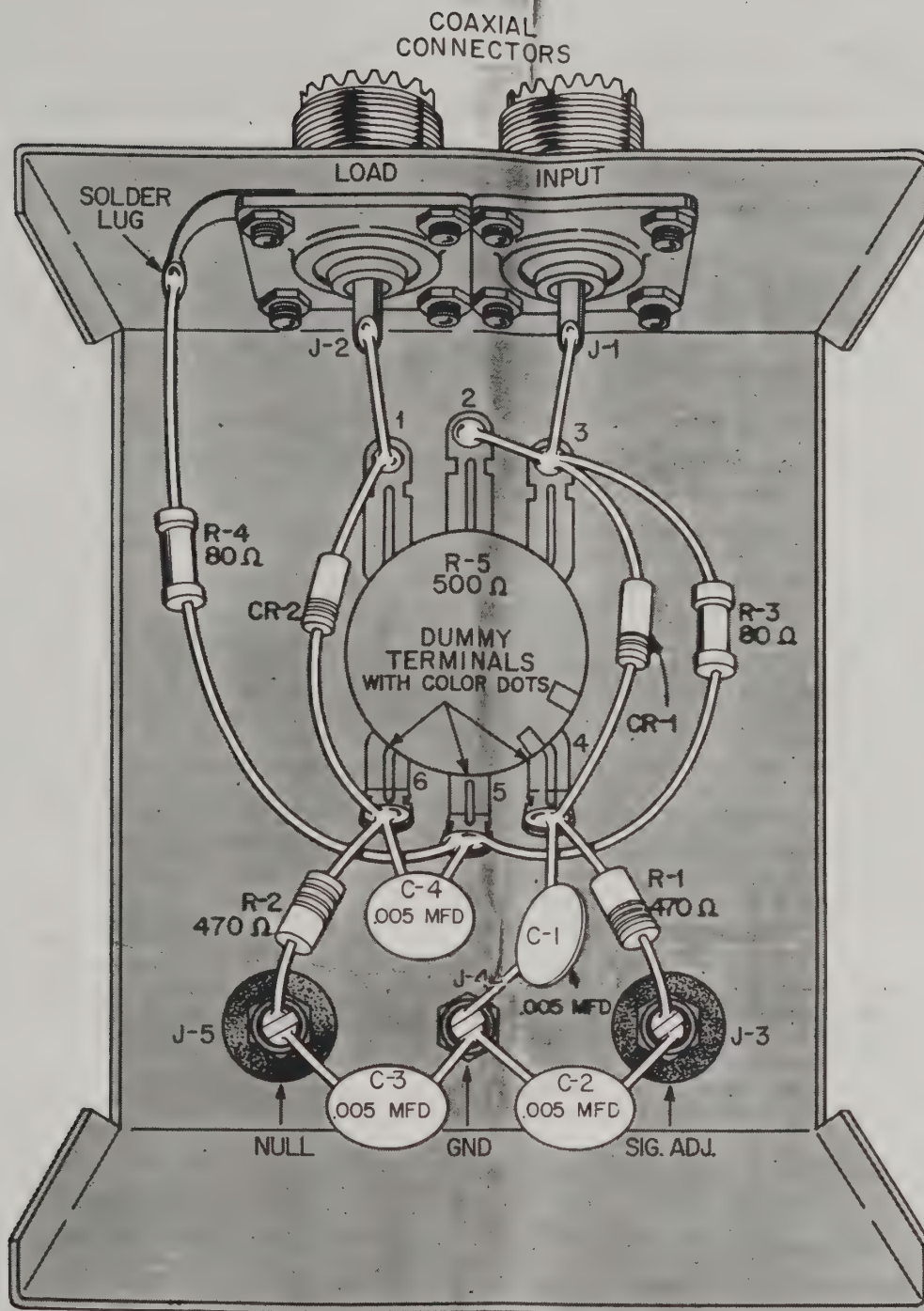


FIGURE 6. WIRING

precision resistor, to terminal 5 of R-5. Solder the other lead to the solder lug mounted under J-2.

- ☐ Notice that one end of CR-1 and CR-2 is marked with **color code bands**. This end may be marked by some manufacturers with a band, a bar, a dot, or a K. To prevent heat damage to the diodes, hold the lead with a pair of long-nose pliers as you solder each lead in place.
- ☐ Connect, but do not solder, the lead from the **marked** end of CR-2 to terminal 6 of R-5. Thread the other lead through terminal 1 of R-5, and then solder it to the terminal on J-2. Solder terminal 1 of R-5.

- ☐ Connect, but do not solder, the lead from the **marked** end of CR-1 to terminal 4 of R-5. Thread the other lead through terminal 3 of R-5, and then solder it to terminal 2 of R-5. Solder terminal 3 of R-5.
- ☐ Connect, but do not solder, one lead of C-3, .005 μ fd (may be marked 5K or 5,000) disc capacitor, to the terminal on J-5. Connect, but do not solder, the other lead to the terminal on J-4.
- ☐ Connect, but do not solder, one lead of C-2, .005 μ fd disc capacitor, to the terminal on J-3. Connect, but do not solder, the other lead to the terminal on J-4.

- ☐ Connect, but do not solder, one lead of C-4, .005 μ fd disc capacitor, to terminal 6 of R-5. Solder the other lead to terminal 5 of R-5.
- ☐ Solder one lead of R-2, 470 Ω resistor (marked with color bands yellow, violet, and brown), to terminal 6 of R-5. Solder the other lead to the terminal on J-5.
- ☐ Connect, but do not solder, one lead of C-1, .005 μ fd disc capacitor, to terminal 4 of R-5. Solder the other lead to the terminal on J-4.

- ☐ Solder one lead of R-1, 470 Ω resistor (yellow, violet, brown), to terminal 4 of R-5. Solder the other lead to the terminal on J-3.
- ☐ Place the cover on the chassis, and secure it in place with two sheet metal screws.

DO NOT ATTEMPT TO USE YOUR RF Z-BRIDGE UNTIL YOU HAVE READ THE FOLLOWING INSTRUCTIONS ON HOW TO USE YOUR RF Z-BRIDGE. IMPROPER OPERATION MAY CAUSE PERMANENT DAMAGE TO YOUR Z-BRIDGE.

HOW TO USE YOUR RF Z-BRIDGE

OPERATING NOTES

Since the RF Z-Bridge requires only a very low power level to operate it, it may be necessary to couple it to a low-power driver stage rather than the final amplifier. The plate voltage and drive to the final amplifier can be reduced if it is desired to use the final amplifier as a source of power. Always connect a suitable dummy load to the transmitter when using the Z-Bridge. Be sure the Z-Bridge coupling and the dummy load coupling to the transmitter remains constant. A grid-dip meter with sufficient output can be used as a source of power to operate the Z-Bridge.

The transmitter should be free from harmonics and other spurious components. Otherwise, a good null may not be obtained. If you encounter difficulty in obtaining a good null, check the transmitter with a wavemeter to insure that only the desired frequency is present.

For additional information refer to The Radio Amateur's Handbook.

CAUTION

DO NOT EXCEED 12.5 VOLTS (MEASURED AT THE SIG. ADJ. JACK) INPUT TO YOUR RF Z-BRIDGE. EXCESSIVE VOLTAGE WILL DAMAGE THE PRECISION RESISTORS AND THE DIODES. ALWAYS DISCONNECT THE Z-BRIDGE FROM THE TRANSMITTER AS SOON AS THE ADJUSTMENTS OR MEASUREMENTS HAVE BEEN COMPLETED.

HOW TO CALIBRATE THE RF Z-BRIDGE

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Temporarily connect one lead of the 72 Ω calibrating resistor to the center terminal of the LOAD coaxial connector (J-2). Connect the other lead to the outer shell of the connector.
3. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the Z-Bridge. Set the meter to a DC range that has 2.5 or 5 volts full scale.
Note: If a VTVM is used, direct pick-up of RF by the VTVM may affect the readings.

4. Connect a suitable dummy load to the output of your transmitter.
5. Loosely couple the INPUT of the Z-Bridge to the transmitter. Only a very low power level is required to operate the Z-Bridge. **A one or two-turn loop, on the end of a coaxial feed line placed near the transmitter's tank coil, will give sufficient pick-up to operate the Z-Bridge.** See Figure 7. The feed line can be connected directly to a pi-type output circuit. Set the coupling to minimum.
6. Adjust the control on the Z-Bridge for best possible null (zero reading). For a more accurate indication, as the null is approached, set the meter to a lower scale.
7. Place the knob on the shaft of the control so that the line on the knob indicates 72 on the scale of the Z-Bridge. Tighten the setscrew. Your RF Z-Bridge is now adjusted for accurate measurements. Disconnect the calibrating resistor and save it for future calibrating of the Z-Bridge.

HOW TO ADJUST MATCHING NETWORKS

SEE FIGURE 7.

1. Set the control of the RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to a DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.
4. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. The frequency of the transmitter should be close to the resonant frequency of the antenna. Only a very low power level is required to operate the RF Z-Bridge. A one or two turn loop on the end of a coaxial feed line, placed near the transmitter's tank coil, will give sufficient pick-up to operate the Z-Bridge. The feed line can be connected directly to a pi-type output circuit. Set the coupling to minimum.

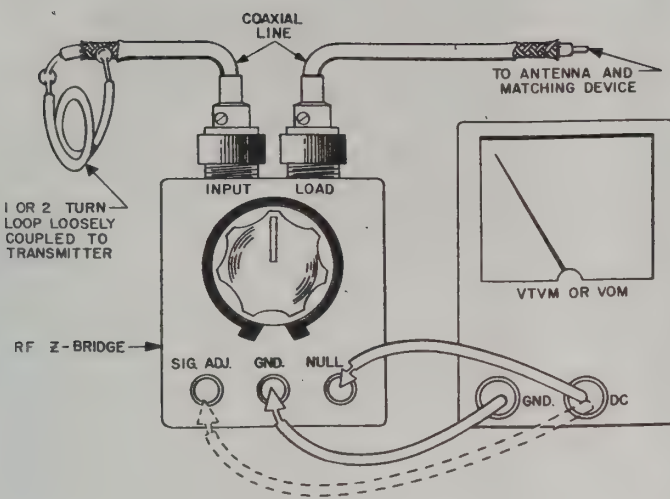


FIGURE 7. TYPICAL SET-UP USING COAXIAL CABLE

5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
7. Connect the load to the LOAD connector on the RF Z-Bridge, and adjust the matching network until the best possible null (zero reading) is obtained.

ADJUSTING THE ANTENNA TO RESONANCE

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to the DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.
4. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. The transmitter must be operating at the desired frequency. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
7. Adjust the matching network (if used) and the length of the antenna for best null. A resonant antenna is purely resistive. Best nulls are obtained with purely resistive loads. The antenna is now resonant at the frequency of the transmitter. Beam antennas should be adjusted with the director 5% shorter and the reflector 5% longer than the driven element.

HOW TO MEASURE STANDING-WAVE RATIO

SEE FIGURE 7.

1. Set the control of your RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to the DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.
4. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Measure the voltage at the SIG ADJ jack with the meter. Make a note of this reading.
7. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
8. Connect the load to be measured to the LOAD connector on the RF Z-Bridge. If a matching network is used, adjust it for best null. Best results are obtained when the load is resonant at the transmitter frequency.
9. Adjust the coupling to the transmitter until the voltage at the SIG ADJ jack reads the same as the reading taken in step 6.
10. Read the voltage at the NULL jack. Determine this reading relative to full scale deflection. If you are using 5 volts full scale deflection, a null reading of 2 volts is .4 of full scale. Meter reading relative to full scale = $\frac{\text{null reading}}{\text{full scale}} = \frac{2}{5} = .4$.
11. Read the SWR from the chart in Figure 8. A meter reading of .4 relative to full scale deflection is a 2.3 to 1 SWR.

IMPEDANCE MEASUREMENT

SEE FIGURE 7.

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. Use a suitable dummy load. The transmitter and the load should be resonant to the same frequency. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
3. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks. Set the meter to a DC range that has 2.5 or 5 volts full scale.

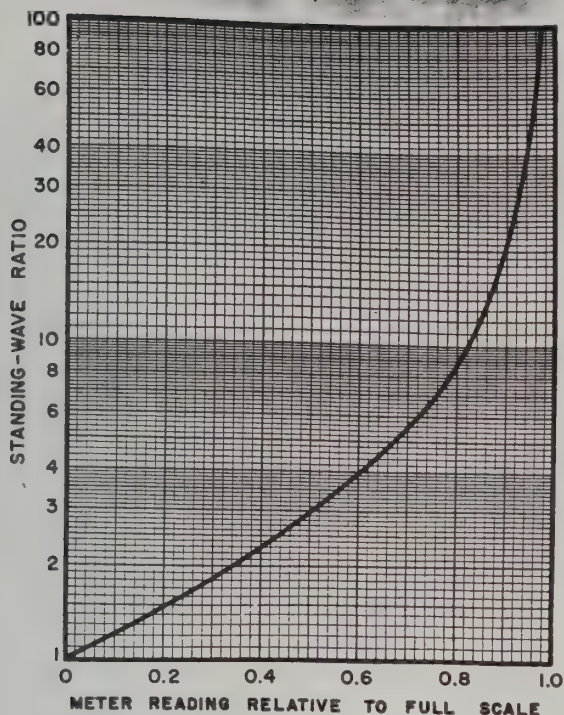


FIGURE 8. STANDING-WAVE RATIO CHART

4. Adjust the coupling to the transmitter for full scale deflection.
5. Connect the load to be measured to the LOAD connector on the RF Z-Bridge. Note: The load can be an antenna, a capacitor, a resistor, or a choke coil. The impedance of any one of these items can be measured at a particular frequency provided the impedance is within the range of 20 to 400 ohms.
6. Adjust the control on the RF Z-Bridge for minimum reading or null on the meter. If the load is purely resistive, a good null will be obtained. But, the more reactive the load, the poorer the null.
7. Read the impedance of the load directly from the scale on the RF Z-Bridge.

HOW TO OBTAIN THE BEST MATCH AND MEASURE THE STANDING-WAVE RATIO USING PARALLEL LINES

SEE FIGURE 9.

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to a DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.

4. Loosely couple the INPUT of the RF Z-Bridge to a transmitter. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
7. Measure the voltage at the SIG ADJ jack with the meter. Make a note of this reading.
8. Connect the load through a suitable antenna coupler to the LOAD connector. Best results are obtained when the load and the transmitter are resonant at the same frequency.
9. Adjust Ca, Cb, and the taps on the antenna coupler (See Figure 9) until the best possible null is obtained. This adjustment provides the best match between the transmission line and the transmitter. To get the broadest frequency response, try to obtain the null with Ca near maximum and with the taps on Lb as far apart as possible. Keep the taps equidistant from the center.
10. Adjust the coupling to the transmitter until the voltage at the SIG ADJ jack reads the same as the reading taken in step 7.
11. Read the voltage at the NULL jack. Determine this reading relative to full scale deflection. If you are using 5 volts full scale deflection, a null reading of 2 volts is .4 relative to full scale. $\text{Meter reading relative to full scale} = \frac{\text{null reading}}{\text{full scale}} = \frac{2}{5} = .4$.
12. Read the SWR from the chart shown in Figure 8.
13. If the SWR of 1-to-1 cannot be obtained, the SWR of the transmission line is high, and the length of the line is unfavorable. A SWR of 3-to-1 or less is usually satisfactory.

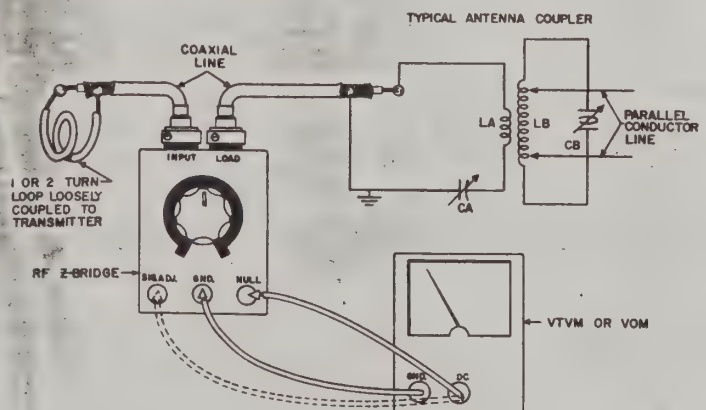


FIGURE 9. TYPICAL SET-UP USING AN ANTENNA COUPLER

HOW TO MEASURE IMPEDANCE USING PARALLEL LINES

SEE FIGURE 10.

1. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks. Set the meter to a DC range that has 2.5 or 5 volts full scale.
3. Adjust the coupling to the transmitter for full scale deflection.
4. Connect the load to be measured through a balun (a device for matching balanced to unbalanced) to the load connector on the RF Z-Bridge.
5. Adjust the control on the RF Z-Bridge for minimum reading or null on the meter. If the load is purely resistive, a good null will be obtained. But,

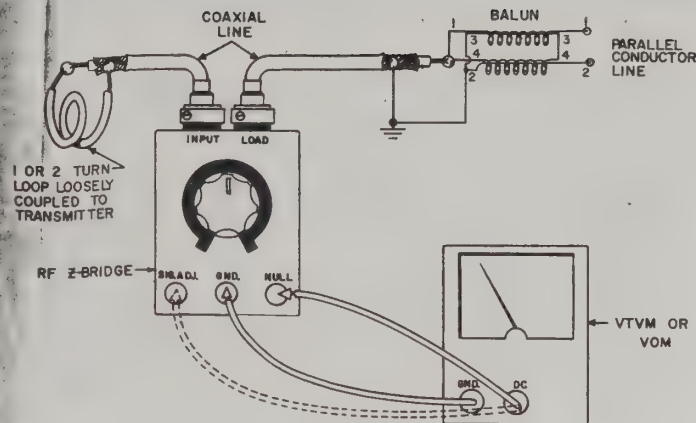


FIGURE 10. TYPICAL SET-UP USING A BALUN

as the reactive component of the load increases the null will be less prominent.

6. Multiply the reading on the RF Z-Bridge by 4 to get the impedance of the load. This is necessary because a balun usually provides a 4-to-1 step-down ratio from balanced to unbalanced.

HOW IT WORKS

The RF Z-Bridge circuit consists of a simple resistance bridge and a diode detector. The bridge is made up of resistors R-3, R-4, R-5, and the load.

Resistors R-3 and R-4 are of identical value so that when the load is equal to R-5, the bridge will be balanced and there will be no voltage applied to CR-2. The resistance of the load will be indicated on the scale. However, if the transmission line does not match the load, the reflected voltage will not see the bridge, and will be indicated by a voltmeter connected

to the NULL jack. This characteristic is used to measure standing-wave ratios of transmission lines.

The crystal diode CR-2 rectifies the RF voltage so that it can be indicated by a DC voltmeter. This rectified voltage is filtered by R-2 and C-3. C-4 is a DC blocking capacitor.

To measure the input signal, a rectifier and filter network comprised of CR-1, R-1, C-1, and C-2 are provided.

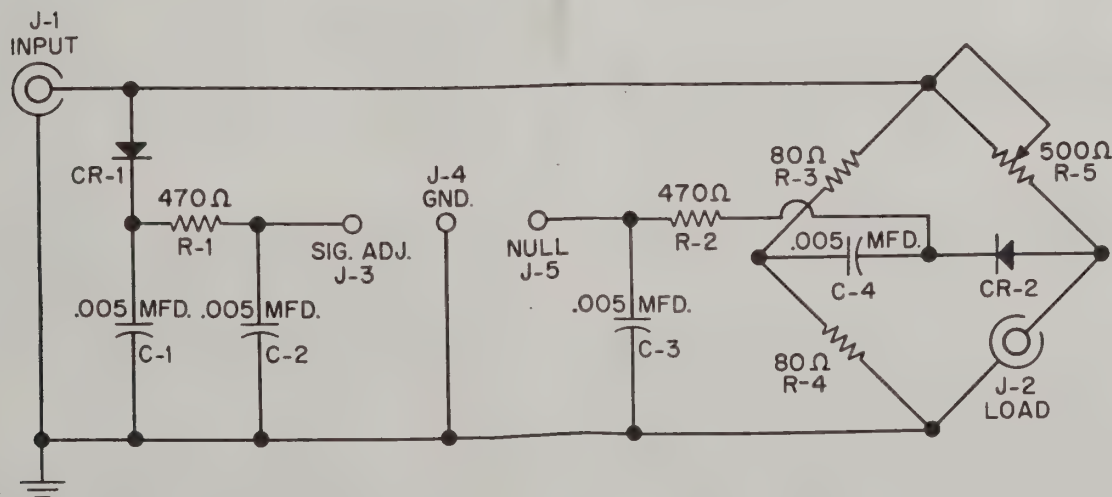


FIGURE 11. SCHEMATIC DIAGRAM

PARTS LIST FOR THE RF Z-BRIDGE

Symbol Number	Description	Part No.
C-1	Capacitor, .005 μ fd disc.....	16L362
C-2	Capacitor, .005 μ fd disc.....	16L362
C-3	Capacitor, .005 μ fd disc.....	16L362
C-4	Capacitor, .005 μ fd disc.....	16L362
CR-1	Diode, crystal.....	630004
CR-2	Diode, crystal.....	630004
J-1	Connector, coaxial.....	40H352
J-2	Connector, coaxial.....	40H352
J-3	Jack, red: with mtg. hardware.....	41H110
J-4	Jack, black: with mtg. hardware.....	41H115
J-5	Jack, red: with mtg. hardware.....	41H110

NOTE: When ordering resistors, give complete description and part number.

R-1	Resistor, 470 Ω , $\frac{1}{2}$ W.....	2MM040
R-2	Resistor, 470 Ω , $\frac{1}{2}$ W.....	2MM040
R-3	Resistor, 80 Ω , $\frac{1}{2}$ W, 1%.....	340800
R-4	Resistor, 80 Ω , $\frac{1}{2}$ W, 1%.....	340800
R-5	Potentiometer, 500 Ω	390400
	Resistor, 72 Ω , $\frac{1}{2}$ W, 1%.....	340720

* Subject To Change.

Description	Qty.	Part No.
Bushing, polystyrene.....	1	870023
Bushing, retainer.....	1	470063
Chart, SWR.....	1	750070
Cover, front.....	1	462244
Cover, rear.....	1	463110
Knob.....	1	761304
Manual.....	1	750069
Nut, hex, #4-36.....	8	570230
Screw, machine: #4-36 x $\frac{3}{8}$	8	560234
Screw, self-tapping: 4 x $\frac{1}{4}$	2	562292
Solder, 6".....	1	46N900
Solder lug, #8.....	1	553002
Washer, flat metal.....	1	580702

TOOLS YOU MAY NEED

Stock No.	Description
46N852.....	Soldering iron
50N132.....	6" long-nose pliers
50N133.....	5" diagonal cutters
45N378.....	6" screwdriver

ALLIED'S GUARANTEE ON KNIGHT KITS

The designs and components selected for KNIGHT kits represent over a quarter of a century of experience in kit development. KNIGHT kits are easy to assemble even for a beginner. The instructions are complete, panels are drilled, the chassis is punched and formed, and every part is included as listed.

Allied extends these firm guarantees on KNIGHT kits:

We guarantee that the circuits in all KNIGHT kits have been carefully engineered and tested.

We guarantee that only high-quality components are supplied. All parts are covered by the standard RETMA 90-day warranty. Any faulty components will be replaced prepaid and without charge if reported to us within the warranty period. We reserve the right to request the return of defective parts.

If your kit was shipped by parcel post and is received in a damaged condition, please write us at once describing the state in which the shipment was received. If your kit was part of a Railway Express shipment that was damaged in transit, please notify the Railway Express agent at once and then write us.

The efficiently engineered KNIGHT kits are moderately priced. When you buy a KNIGHT kit you get the best in design, quality, and value. Recommend KNIGHT kits to your friends.

ALLIED'S SERVICE FACILITIES

If the kit does not operate properly, we recommend the following:

Please write our Kit Department giving the stock number and date of purchase of the kit. Also, describe fully what appears to be wrong. Details as to which controls or sections of the circuit do not function properly will help us analyze the problem. We may be able to determine a wiring error or a defective part.

This wired KNIGHT kit may be returned for inspection within one year after purchase for a special service charge of \$2.00. Parts within the standard RETMA 90-day warranty period will be replaced without charge for the parts. A charge will be made for parts damaged in construction or because of a wiring error, or for parts which are beyond the 90-day warranty period. After the one year period, service charges are based on the length of time required to repair the unit plus the cost of any new parts that may be needed.

PLEASE NOTE: KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX ARE NOT ELIGIBLE FOR REPAIR OR SERVICE AND WILL HAVE TO BE RETURNED NOT REPAIRED AT YOUR EXPENSE.

Allied's service facilities are primarily for inspection and trouble-shooting. Kits not completely wired, which require extensive work, will be returned collect with a letter of explanation.

If you return this kit, pack it well. To prevent damage in shipment, use a large enough carton so that cushioning material can be placed around the unit. Cushion it well and tightly. Mark the carton, "FRAGILE — DELICATE ELECTRONIC INSTRUMENT." Send the kit prepaid and insured. We will return the repaired kit to you C.O.D. as soon as repairs are completed. If you wish to save C.O.D. fees, your advance remittance may be enclosed to cover the standard repair charges plus transportation costs. Any excess money will be refunded.

Other Famous **knight-kits** For the **AMATEUR**



knight-kit
50-WATT TRANSMITTER
83YX255

Whether you're looking for a low-cost transmitter to put you "on-the-air"; or, a dependable stand-by rig—you'll do well to check through all of the many desirable features of the KNIGHT-KIT transmitter.

The KNIGHT-KIT transmitter is a complete, self-contained, bandswitching cw transmitter kit that can be operated crystal controlled or with external vfo.

With all parts, tubes, pre-cut wire, solder, and step-by-step instructions.



knight-kit
VFO
83Y725

The KNIGHT-KIT VFO offers high-quality performance at incomparably low cost. Look over its array of outstanding features and you'll see that it includes everything desirable in vfo design. It's a completed vfo with built-in transformer type power supply. Features extremely high stability, excellent oscillator keying characteristic for fast break-in operation, highly effective TVI suppression, easy tuning and ultra-compact construction.

Exceptional frequency stability is assured by careful circuit design and rigid mechanical construction. Drift free, series-tuned Clapp oscillator employs 1% silver mica capacitors. Oscillator tank coil is wound on heavy ceramic form. Excellent voltage regulation maintains stable output, unaffected by changes in line voltage. Rugged mechanical construction—oscillator chassis is flange-welded for rigidity; bandswitch is heavy ceramic. Has Calibrate-Standby-Transmit switch for "no-swish" tuning. Extra switch contacts are connected to a terminal strip on rear of chassis for control of external equipment.

Complete with all parts, tubes, pre-cut wire, solder, and step-by-step instructions.

SPECIFICATIONS

Output Frequencies: 3.5 — 4 mc
7.0 — 7.3 mc
14.0 — 14.3 mc
21.0 — 21.5 mc
27.0 — 27.2 mc
28.0 — 29.7 mc

Power Input To Final Amplifier: 50 watts minimum on all bands.

Frequency Control: Quartz crystal or external vfo.

Output Circuit: Pi-network, capable of matching unbalanced loads between 50 and 1200 ohms. Will tune out large amounts of reactance. Connection to the output is through an SO-239 type coaxial connector.

Tubes: 6AG7 crystal oscillator-multiplier (buffer-multiplier when vfo used), 807 power amplifier, 5U4G rectifier.

Modulation: Provision is made for the connection of an external modulator.

VFO Operation: The KNIGHT 50-Watt Amateur Transmitter may be controlled by any vfo supplying 8 to 10 volts across 22,000 ohms, and delivering output in the 160, 80, or 40 meter bands. The KNIGHT VFO is ideally suited.

TVI Reduction: The transmitter is completely shielded by its cabinet, with firm metal-to-metal seals provided at all metal junctions. The copper finished chassis is well bonded to both front and rear of the cabinet, thus assuring minimum harmonic radiation. Filtering and bypassing of AC and keying leads is provided, and generous bypassing of the meter and heater circuits is included.

Size: 10½ x 8½ x 8¼".

Shipping Weight: 18 lbs.

SPECIFICATIONS

Frequency Coverage: 80, 40, 20, 15, 11, and 10 meter bands.

RF Output: 40 volt output on 80 meters; 20 volt output on 40 meters. Dial calibrated on all bands.

Tubes: 6BH6 Clapp oscillator, 6BH6 buffer-doubler, 6X4 rectifier, and OA2 voltage regulator.

Power Source: 110 to 120 volts, 50 to 60 cycles.

Size: 8¾ x 6 x 6".

Shipping Weight: 8 lbs.

38K198

See your latest catalog for current prices.

THE knight-kit[®]

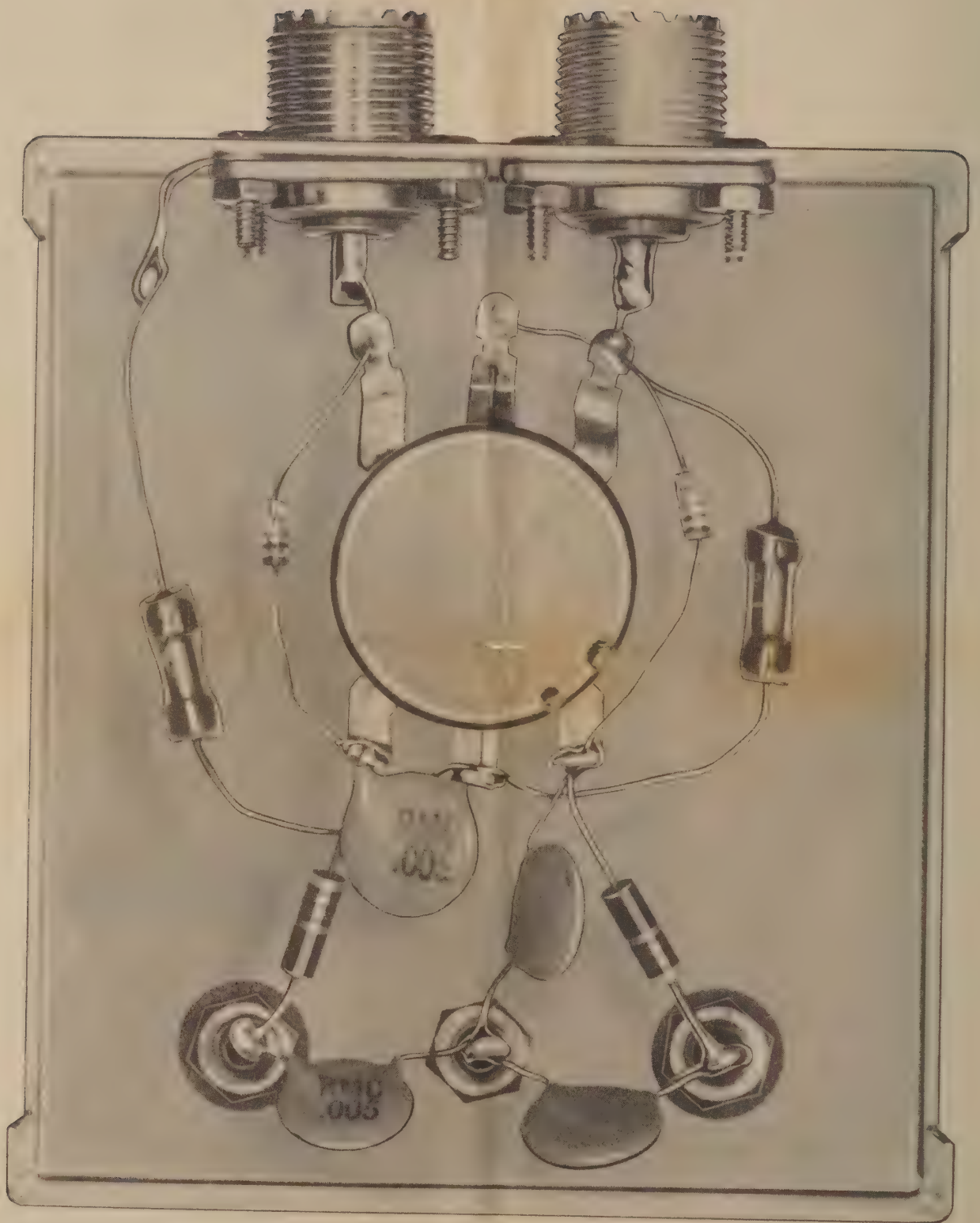
RF Z-BRIDGE



ALLIED RADIO
CORPORATION



100 N. WESTERN AVE. • CHICAGO 80, ILL. HAYMARKET 1-6800



SPECIFICATIONS

Useful To Measure antenna impedance,
Measure standing-wave
ratio,
Adjust matching networks,
Tune antennas to resonance.

Frequency Range 100 KC to 144 MC

Impedance Range 20 Ω to 400 Ω

Meter Required 5000 Ω /volt or greater

Size 2½ x 3½ x 4"

Approx. Shpg. Weight .2 lbs.

INTRODUCTION

This RF Z-Bridge can be used to measure antenna impedance, to tune antennas to resonance, to match transmission lines for minimum SWR, and to adjust antenna couplers and matching networks. These adjustments are necessary for maximum power transfer from a transmitter to an antenna.

CHECKING YOUR KIT

Before starting to build your RF Z-Bridge, check each part against the Parts List on page 11. This will help you become acquainted with each part. If you are unable to identify some of the parts by sight, locate them on the pictorial diagrams. To keep our kits at the lowest possible price, we frequently weigh the hardware rather than count it. It is common for more screws or nuts to be supplied than are specified in the Parts List.

CONSTRUCTION HINTS

The only tools required for building your RF Z-Bridge are: Long-nose pliers, diagonal cutters, medium size screwdriver, setscrew driver, and soldering iron. A good set of tools is listed on the Parts List page.

Study the pictorial diagrams and note how the parts are mounted. These pictorial diagrams show the actual location of all parts and wires. The schematic diagram shows how the parts are connected electrically and is helpful in understanding how the circuits work.

The step-by-step instructions were prepared while a skilled technician was actually building the RF Z-Bridge. We suggest that you check off each step, in the space provided, after you have completed it. Some builders also like to put a pencil mark on the wiring as they complete it.

WIRING AND SOLDERING

Poorly soldered connections are often responsible for poorly functioning or inoperative equipment. A little care taken in wiring and soldering will be well rewarded with a professional looking and a reliable operating instrument. For this reason, we urge you to read the following paragraphs before proceeding with the building of your RF Z-Bridge.

When connecting wires to a terminal, bend the end of the wire around the terminal, and clamp it tightly with long-nose pliers. See Figure 1. This assures a good mechanical connection. Solder must not be used to supply mechanical strength – its only purpose is to assure a good electrical connection between two conductors. Before connecting a wire to a terminal, be sure the terminal and the wire are clean. If necessary, scrape off any foreign material, such as wax, dirt, or enamel with a knife. Be careful not to nick the wire with the knife or it may break when it is bent.

The proper way to connect a component is also illustrated in Figure 1. Pull the end leads of the part being mounted through the holes in the mounting terminals so that the part is tightly mounted. After the part is mounted, bend its leads around the mounting terminals and cut off the excess wire.

Leads on resistors and capacitors are usually longer than needed. These leads should be cut to the proper length when the parts are wired in place. This will result in better operation and neater appearance.

For most electronic work, a soldering iron rated at 60 to 100 watts with a medium-sized tip should be used. To make soldering easier and to get the maximum transfer of heat from the iron to the work, the tip of the soldering iron should be properly tinned. To tin the tip of a soldering iron, clean it with steel wool, or a fine file, until the bright copper surface is seen. Allow the iron to heat until it melts solder when it is held against the tip. Coat the tip of the iron with a thin layer of solder. While the iron is still hot, wipe the tip with a soft rag to remove the excess solder. The tip should now have a "shiny" appearance. When using the iron, occasionally check for proper tinning. Try to keep a thin film of solder on

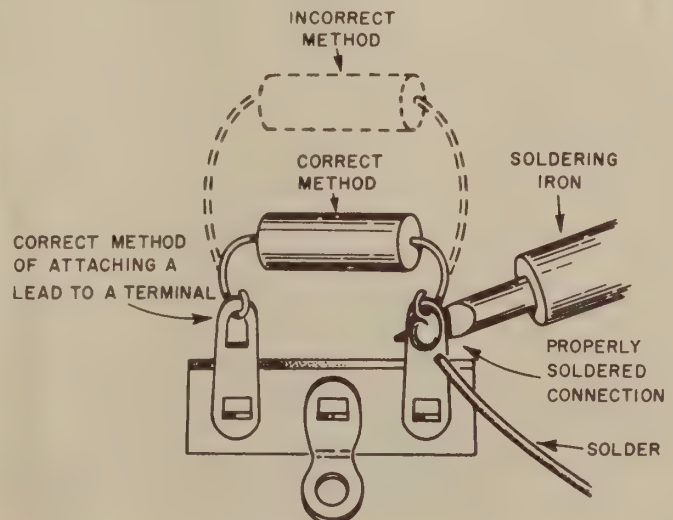


FIGURE 1. HOW TO WIRE AND SOLDER

the tip at all times. Re-tin the iron whenever it becomes covered with a layer of scale.

To solder a connection, hold the tip of the iron against the connection until the connection is hot enough to melt solder. Apply solder to the connection, not to the tip of the iron. Allow just enough solder to flow onto the connection to fill the crevices between the wires and the terminal. Too much solder will result in a poorly soldered connection rather than a better one. Do not disturb the soldered connection until the solder has hardened. If the connection is disturbed, you will have what is known as a "cold solder joint". Cold solder joints are not good elec-

trical connections. If you should accidentally disturb the connection and it hardens with a dull, frosty appearance, re-heat the connection and apply a small amount of solder to it.

USE ONLY ROSIN CORE SOLDER

USE THE ROSIN CORE SOLDER SUPPLIED IN THE KIT. KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX WILL CORRODE AND WILL NOT WORK LONG. SUCH KITS ARE NOT ELIGIBLE FOR REPAIR OR SERVICE.

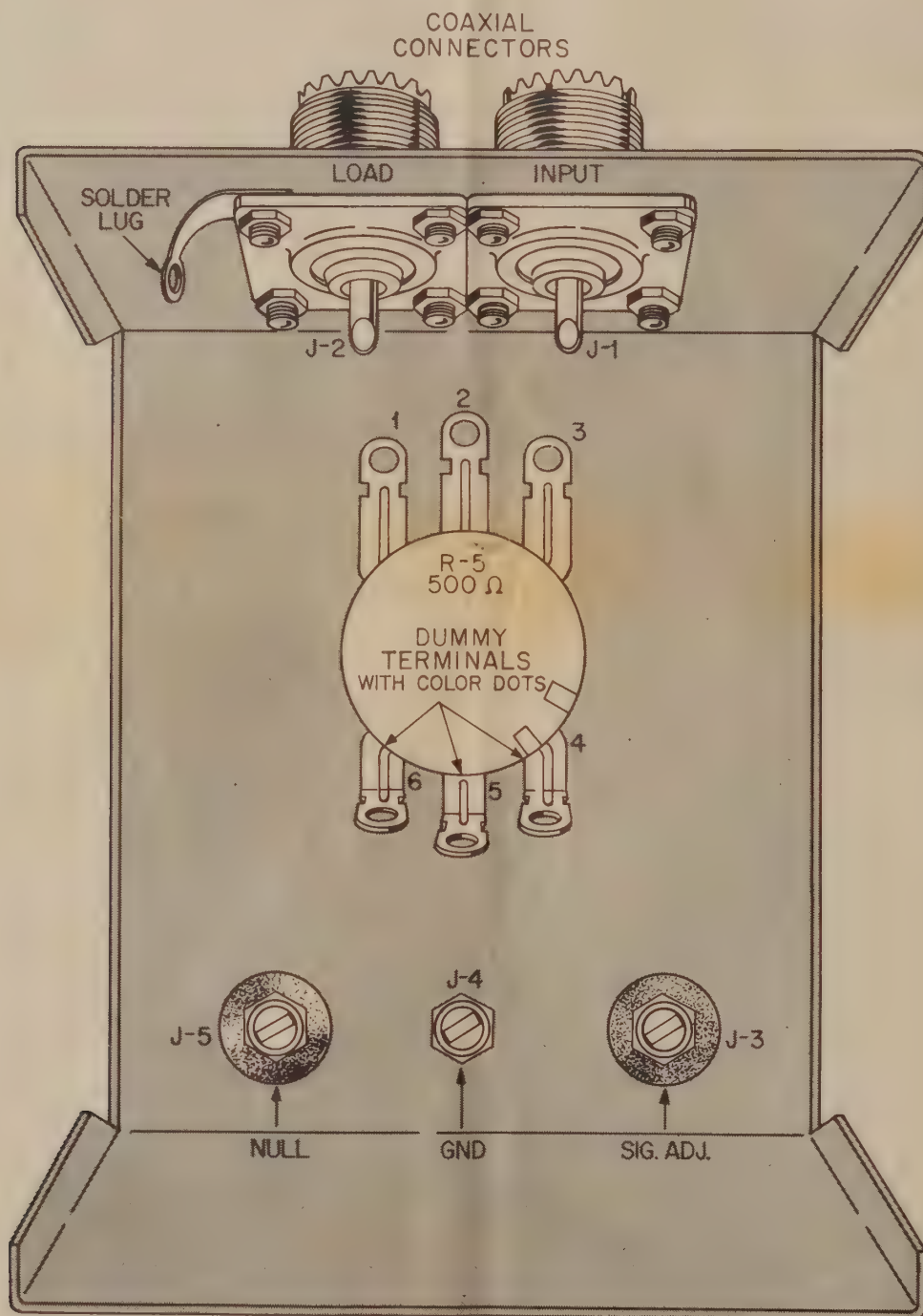


FIGURE 2. PARTS MOUNTING

PARTS MOUNTING

SEE FIGURE 2.

- ☒ On the inside of the chassis, scrape the paint from around the holes used to mount the INPUT and LOAD (J-1 & J-2) coaxial connectors, as shown in Figure 3.
- ☒ From the inside of the chassis, insert the threaded end of J-1, the INPUT coaxial connector, into its mounting hole. Secure J-1 in place with four screws and nuts.

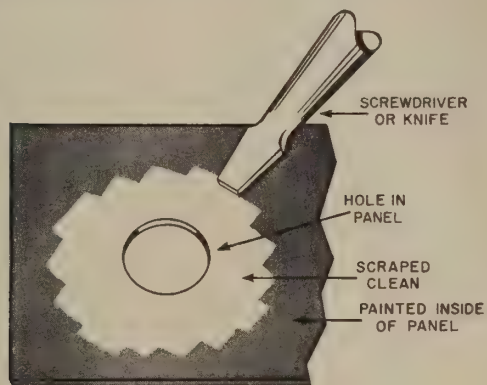


FIGURE 3. HOW TO SCRAPE PAINT

- ☒ In a like manner, mount J-2, the LOAD coaxial connector. Be sure to mount the solder lug, between J-2 and the chassis, on the upper left screw.
- ☐ Mount J-3, one of the red pin jacks, in the hole marked SIG ADJ. Use a fiber shoulder washer and a nut to hold J-3 in place. See Figure 4.
- ☒ In a like manner, mount J-5, a red pin jack, in the hole marked NULL. See Figure 4.
- ☒ On the inside of the chassis, scrape the paint from around the hole marked GND. See Figure 3.
- ☐ Mount J-4, the black pin jack, in the hole marked GND. DO NOT use a fiber shoulder washer. See Figure 4.

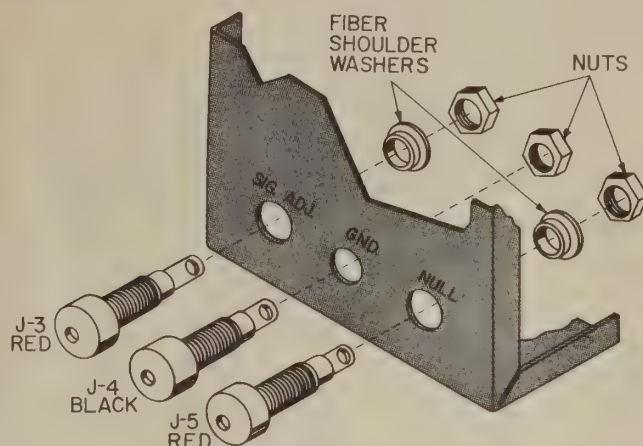


FIGURE 4. PIN JACK MOUNTING

- ☐ Note that R-5, the 500 Ω potentiometer, has three **dummy** terminals marked with **color dots**. Mount R-5 following the assembly details shown in Figure 5. Position the dummy terminals so that they face the three pin jacks.

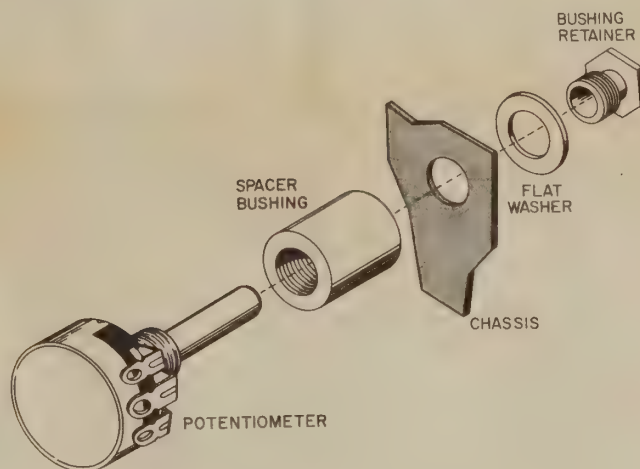


FIGURE 5. MOUNTING THE POTENTIOMETER

WIRING

Remember, use **ONLY THE ROSIN CORE SOLDER** supplied.

SEE FIGURE 6.

- ☐ Bend terminals 1, 2, and 3 of R-5 to a horizontal position.

- ☐ Connect, but do not solder, one lead of R-3, 80 Ω precision resistor, to terminal 5 of R-5. Thread the other lead through terminal 3 of R-5, and then solder it to the terminal on J-1. Do not solder terminal 3 of R-5.

- ☐ Connect, but do not solder, one lead of R-4, 80 Ω

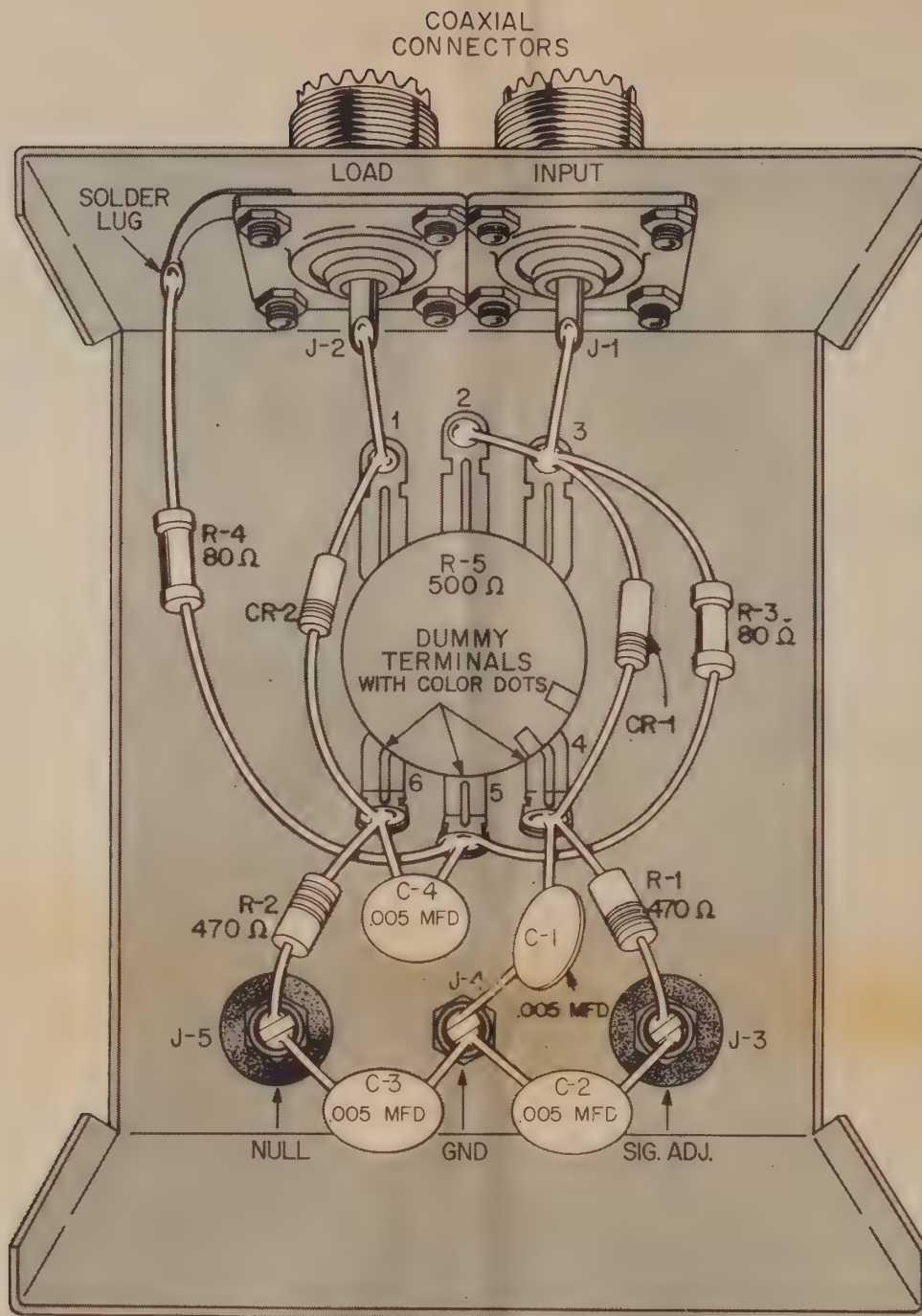


FIGURE 6. WIRING

precision resistor, to terminal 5 of R-5. Solder the other lead to the solder lug mounted under J-2.

- ☐ Notice that one end of CR-1 and CR-2 is marked with **color code bands**. This end may be marked by some manufacturers with a band, a bar, a dot, or a K. To prevent heat damage to the diodes, hold the lead with a pair of long-nose pliers as you solder each lead in place.
- ☐ Connect, but do not solder, the lead from the **marked** end of CR-2 to terminal 6 of R-5. Thread the other lead through terminal 1 of R-5, and then solder it to the terminal on J-2. Solder terminal 1 of R-5.

- ☐ Connect, but do not solder, the lead from the **marked** end of CR-1 to terminal 4 of R-5. Thread the other lead through terminal 3 of R-5, and then solder it to terminal 2 of R-5. Solder terminal 3 of R-5.

- ☐ Connect, but do not solder, one lead of C-3, .005 μ fd (may be marked 5K or 5,000) disc capacitor, to the terminal on J-5. Connect, but do not solder, the other lead to the terminal on J-4.

- ☐ Connect, but do not solder, one lead of C-2, .005 μ fd disc capacitor, to the terminal on J-3. Connect, but do not solder, the other lead to the terminal on J-4.

- ☐ Connect, but do not solder, one lead of C-4, .005 μ fd disc capacitor, to terminal 6 of R-5. Solder the other lead to terminal 5 of R-5.
- ☐ Solder one lead of R-2, 470 Ω resistor (marked with color bands yellow, violet, and brown), to terminal 6 of R-5. Solder the other lead to the terminal on J-5.
- ☐ Connect, but do not solder, one lead of C-1, .005 μ fd disc capacitor, to terminal 4 of R-5. Solder the other lead to the terminal on J-4.

- ☐ Solder one lead of R-1, 470 Ω resistor (yellow, violet, brown), to terminal 4 of R-5. Solder the other lead to the terminal on J-3.
- ☐ Place the cover on the chassis, and secure it in place with two sheet metal screws.

DO NOT ATTEMPT TO USE YOUR RF Z-BRIDGE UNTIL YOU HAVE READ THE FOLLOWING INSTRUCTIONS ON HOW TO USE YOUR RF Z-BRIDGE. IMPROPER OPERATION MAY CAUSE PERMANENT DAMAGE TO YOUR Z-BRIDGE.

HOW TO USE YOUR RF Z-BRIDGE

OPERATING NOTES

Since the RF Z-Bridge requires only a very low power level to operate it, it may be necessary to couple it to a low-power driver stage rather than the final amplifier. The plate voltage and drive to the final amplifier can be reduced if it is desired to use the final amplifier as a source of power. Always connect a suitable dummy load to the transmitter when using the Z-Bridge. Be sure the Z-Bridge coupling and the dummy load coupling to the transmitter remains constant. A grid-dip meter with sufficient output can be used as a source of power to operate the Z-Bridge.

The transmitter should be free from harmonics and other spurious components. Otherwise, a good null may not be obtained. If you encounter difficulty in obtaining a good null, check the transmitter with a wavemeter to insure that only the desired frequency is present.

For additional information refer to The Radio Amateur's Handbook.

CAUTION

DO NOT EXCEED 12.5 VOLTS (MEASURED AT THE SIG. ADJ. JACK) INPUT TO YOUR RF Z-BRIDGE. EXCESSIVE VOLTAGE WILL DAMAGE THE PRECISION RESISTORS AND THE DIODES. ALWAYS DISCONNECT THE Z-BRIDGE FROM THE TRANSMITTER AS SOON AS THE ADJUSTMENTS OR MEASUREMENTS HAVE BEEN COMPLETED.

HOW TO CALIBRATE THE RF Z-BRIDGE

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Temporarily connect one lead of the 72 Ω calibrating resistor to the center terminal of the LOAD coaxial connector (J-2). Connect the other lead to the outer shell of the connector.
3. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the Z-Bridge. Set the meter to a DC range that has 2.5 or 5 volts full scale.
Note: If a VTVM is used, direct pick-up of RF by the VTVM may affect the readings.

4. Connect a suitable dummy load to the output of your transmitter.
5. Loosely couple the INPUT of the Z-Bridge to the transmitter. Only a very low power level is required to operate the Z-Bridge. **A one or two-turn loop, on the end of a coaxial feed line placed near the transmitter's tank coil, will give sufficient pick-up to operate the Z-Bridge.** See Figure 7. The feed line can be connected directly to a pi-type output circuit. Set the coupling to minimum.
6. Adjust the control on the Z-Bridge for best possible null (zero reading). For a more accurate indication, as the null is approached, set the meter to a lower scale.
7. Place the knob on the shaft of the control so that the line on the knob indicates 72 on the scale of the Z-Bridge. Tighten the setscrew. Your RF Z-Bridge is now adjusted for accurate measurements. Disconnect the calibrating resistor and save it for future calibrating of the Z-Bridge.

HOW TO ADJUST MATCHING NETWORKS

SEE FIGURE 7.

1. Set the control of the RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to a DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.
4. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. The frequency of the transmitter should be close to the resonant frequency of the antenna. Only a very low power level is required to operate the RF Z-Bridge. A one or two turn loop on the end of a coaxial feed line, placed near the transmitter's tank coil, will give sufficient pick-up to operate the Z-Bridge. The feed line can be connected directly to a pi-type output circuit. Set the coupling to minimum.

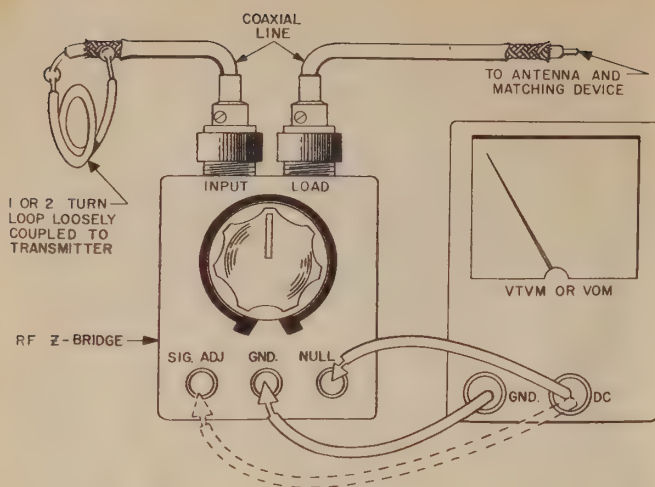


FIGURE 7. TYPICAL SET-UP USING COAXIAL CABLE

5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
7. Connect the load to the LOAD connector on the RF Z-Bridge, and adjust the matching network until the best possible null (zero reading) is obtained.

ADJUSTING THE ANTENNA TO RESONANCE

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to the DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.
4. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. The transmitter must be operating at the desired frequency. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
7. Adjust the matching network (if used) and the length of the antenna for best null. A resonant antenna is purely resistive. Best nulls are obtained with purely resistive loads. The antenna is now resonant at the frequency of the transmitter. Beam antennas should be adjusted with the director 5% shorter and the reflector 5% longer than the driven element.

HOW TO MEASURE STANDING-WAVE RATIO

SEE FIGURE 7.

1. Set the control of your RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to the DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.
4. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Measure the voltage at the SIG ADJ jack with the meter. Make a note of this reading.
7. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
8. Connect the load to be measured to the LOAD connector on the RF Z-Bridge. If a matching network is used, adjust it for best null. Best results are obtained when the load is resonant at the transmitter frequency.
9. Adjust the coupling to the transmitter until the voltage at the SIG ADJ jack reads the same as the reading taken in step 6.
10. Read the voltage at the NULL jack. Determine this reading relative to full scale deflection. If you are using 5 volts full scale deflection, a null reading of 2 volts is .4 of full scale. Meter reading relative to full scale = $\frac{\text{null reading}}{\text{full scale}}$

$$\frac{2}{5} = .4$$
11. Read the SWR from the chart in Figure 8. A meter reading of .4 relative to full scale deflection is a 2.3 to 1 SWR.

IMPEDANCE MEASUREMENT

SEE FIGURE 7.

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. Use a suitable dummy load. The transmitter and the load should be resonant to the same frequency. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
3. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks. Set the meter to a DC range that has 2.5 or 5 volts full scale.

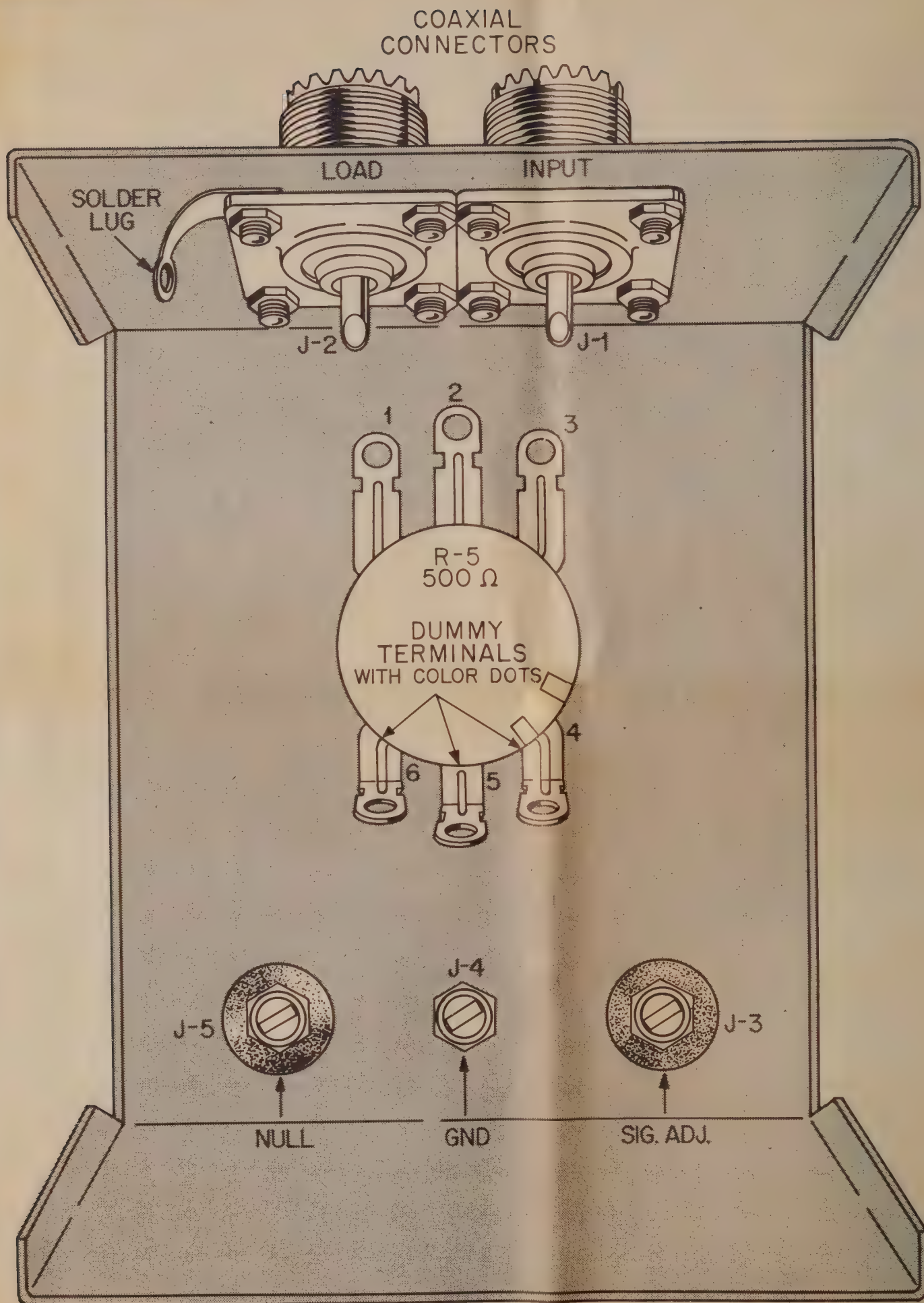


FIGURE 2. PARTS MOUNTING

COAXIAL CONNECTORS

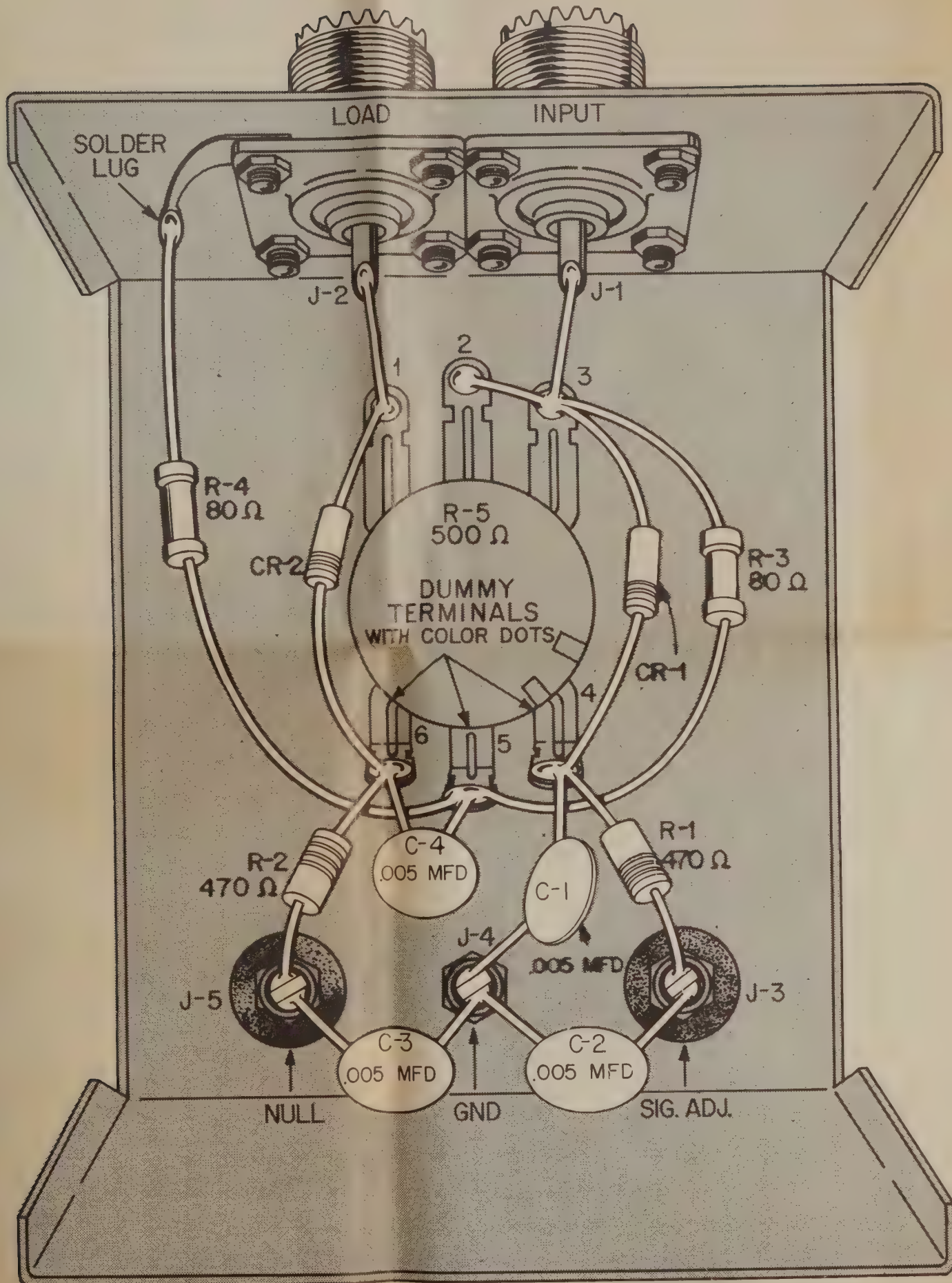


FIGURE 6. WIRING

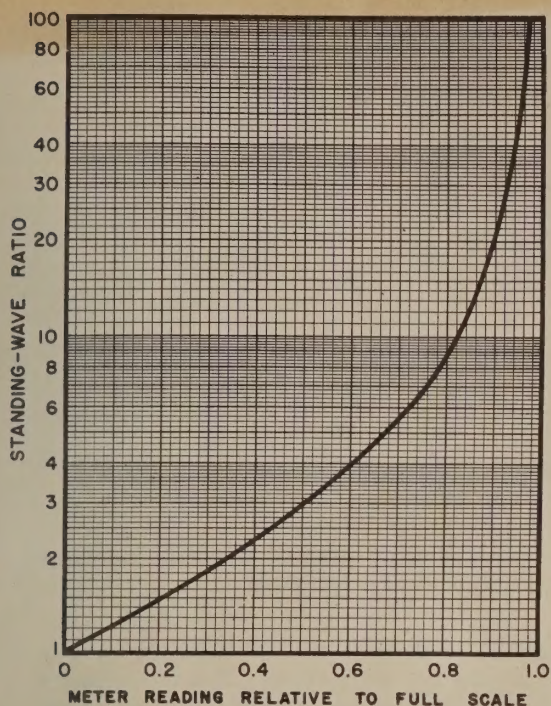


FIGURE 8. STANDING-WAVE RATIO CHART

4. Adjust the coupling to the transmitter for full scale deflection.
5. Connect the load to be measured to the LOAD connector on the RF Z-Bridge. Note: The load can be an antenna, a capacitor, a resistor, or a choke coil. The impedance of any one of these items can be measured at a particular frequency provided the impedance is within the range of 20 to 400 ohms.
6. Adjust the control on the RF Z-Bridge for minimum reading or null on the meter. If the load is purely resistive, a good null will be obtained. But, the more reactive the load, the poorer the null.
7. Read the impedance of the load directly from the scale on the RF Z-Bridge.

HOW TO OBTAIN THE BEST MATCH AND MEASURE THE STANDING-WAVE RATIO USING PARALLEL LINES

SEE FIGURE 9.

1. Set the control on the RF Z-Bridge fully counter-clockwise.
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks on the RF Z-Bridge. Set the meter to a DC range that has 2.5 or 5 volts full scale.
3. Connect a suitable dummy load to the output of your transmitter.

4. Loosely couple the INPUT of the RF Z-Bridge to a transmitter. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
5. Adjust the coupling to the transmitter to obtain full scale deflection.
6. Set the control on the RF Z-Bridge to the impedance of the transmission line being used.
7. Measure the voltage at the SIG ADJ jack with the meter. Make a note of this reading.
8. Connect the load through a suitable antenna coupler to the LOAD connector. Best results are obtained when the load and the transmitter are resonant at the same frequency.
9. Adjust Ca, Cb, and the taps on the antenna coupler (See Figure 9) until the best possible null is obtained. This adjustment provides the best match between the transmission line and the transmitter. To get the broadest frequency response, try to obtain the null with Ca near maximum and with the taps on Lb as far apart as possible. Keep the taps equidistant from the center.
10. Adjust the coupling to the transmitter until the voltage at the SIG ADJ jack reads the same as the reading taken in step 7.
11. Read the voltage at the NULL jack. Determine this reading relative to full scale deflection. If you are using 5 volts full scale deflection, a null reading of 2 volts is .4 relative to full scale. Meter reading relative to full scale = $\frac{\text{null reading}}{\text{full scale}} = \frac{2/5}{1} = .4$.
12. Read the SWR from the chart shown in Figure 8.
13. If the SWR of 1-to-1 cannot be obtained, the SWR of the transmission line is high, and the length of the line is unfavorable. A SWR of 3-to-1 or less is usually satisfactory.

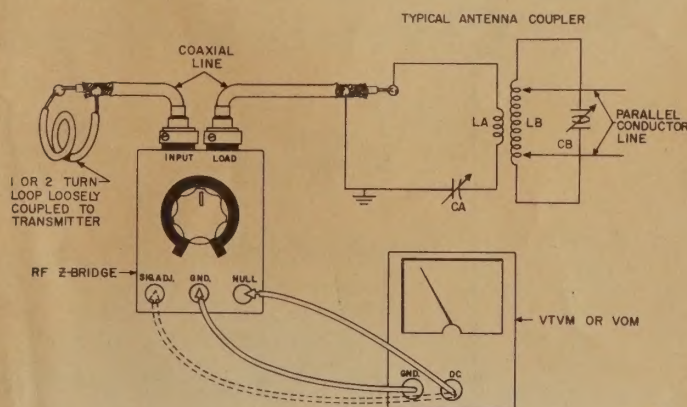


FIGURE 9. TYPICAL SET-UP USING AN ANTENNA COUPLER

HOW TO MEASURE IMPEDANCE USING PARALLEL LINES

SEE FIGURE 10.

1. Loosely couple the INPUT of the RF Z-Bridge to the transmitter. Refer to step 5 of "How to Calibrate the RF Z-Bridge."
2. Connect a 5K Ω /volt or greater VOM to the NULL and GND jacks. Set the meter to a DC range that has 2.5 or 5 volts full scale.
3. Adjust the coupling to the transmitter for full scale deflection.
4. Connect the load to be measured through a balun (a device for matching balanced to unbalanced) to the load connector on the RF Z-Bridge.
5. Adjust the control on the RF Z-Bridge for minimum reading or null on the meter. If the load is purely resistive, a good null will be obtained. But,

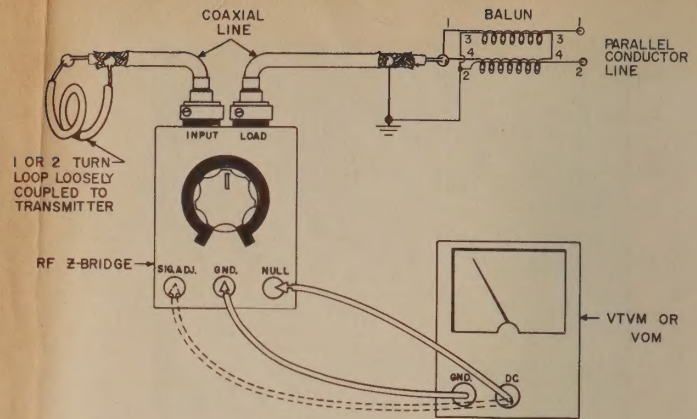


FIGURE 10. TYPICAL SET-UP USING A BALUN

as the reactive component of the load increases the null will be less prominent.

6. Multiply the reading on the RF Z-Bridge by 4 to get the impedance of the load. This is necessary because a balun usually provides a 4-to-1 step-down ratio from balanced to unbalanced.

HOW IT WORKS

The RF Z-Bridge circuit consists of a simple resistance bridge and a diode detector. The bridge is made up of resistors R-3, R-4, R-5, and the load.

Resistors R-3 and R-4 are of identical value so that when the load is equal to R-5, the bridge will be balanced and there will be no voltage applied to CR-2. The resistance of the load will be indicated on the scale. However, if the transmission line does not match the load, the reflected voltage will not see the bridge, and will be indicated by a voltmeter connected

to the NULL jack. This characteristic is used to measure standing-wave ratios of transmission lines.

The crystal diode CR-2 rectifies the RF voltage so that it can be indicated by a DC voltmeter. This rectified voltage is filtered by R-2 and C-3. C-4 is a DC blocking capacitor.

To measure the input signal, a rectifier and filter network comprised of CR-1, R-1, C-1, and C-2 are provided.

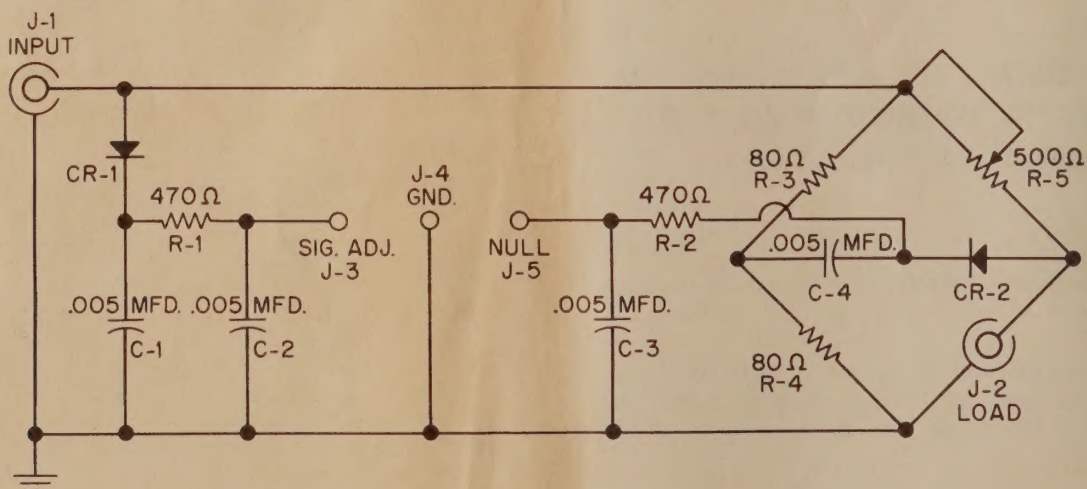


FIGURE 11. SCHEMATIC DIAGRAM

PARTS LIST FOR THE RF Z-BRIDGE

Symbol Number	Description	Part No.
C-1	Capacitor, .005 μ fd disc.....	16L362
C-2	Capacitor, .005 μ fd disc.....	16L362
C-3	Capacitor, .005 μ fd disc.....	16L362
C-4	Capacitor, .005 μ fd disc.....	16L362
CR-1	Diode, crystal.....	630004
CR-2	Diode, crystal.....	630004
J-1	Connector, coaxial.....	40H352
J-2	Connector, coaxial.....	40H352
J-3	Jack, red: with mtg. hardware.....	41H110
J-4	Jack, black: with mtg. hardware.....	41H115
J-5	Jack, red: with mtg. hardware.....	41H110

NOTE: When ordering resistors, give complete description and part number.

R-1	Resistor, 470 Ω , $\frac{1}{2}$ W.....	2MM040
R-2	Resistor, 470 Ω , $\frac{1}{2}$ W.....	2MM040
R-3	Resistor, 80 Ω , $\frac{1}{2}$ W, 1%.....	340800
R-4	Resistor, 80 Ω , $\frac{1}{2}$ W, 1%.....	340800
R-5	Potentiometer, 500 Ω	390400
	Resistor, 72 Ω , $\frac{1}{2}$ W, 1%.....	340720

* Subject To Change.

Description	Qty.	Part No.
Bushing, polystyrene.....	1	870023
Bushing, retainer.....	1	470068
Chart, SWR.....	1	750070
Cover, front.....	1	462244
Cover, rear.....	1	463110
Knob.....	1	761304
Manual.....	1	750069
Nut, hex, #4-36.....	8	570230
Screw, machine: #4-36 x $\frac{3}{8}$	8	560234
Screw, self-tapping: 4 x $\frac{1}{4}$	2	562232
Solder, 6".....	1	46N900
Solder lug, #8.....	1	553002
Washer, flat metal.....	1	580702

TOOLS YOU MAY NEED

Stock No.	Description
46N852.....	Soldering iron
50N132.....	6" long-nose pliers
50N133.....	5" diagonal cutters
45N378.....	6" screwdriver

ALLIED'S GUARANTEE ON KNIGHT KITS

The designs and components selected for KNIGHT kits represent over a quarter of a century of experience in kit development. KNIGHT kits are easy to assemble even for a beginner. The instructions are complete, panels are drilled, the chassis is punched and formed, and every part is included as listed.

Allied extends these firm guarantees on KNIGHT kits:

We guarantee that the circuits in all KNIGHT kits have been carefully engineered and tested.

We guarantee that only high-quality components are supplied. All parts are covered by the standard RETMA 90-day warranty. Any faulty components will be replaced prepaid and without charge if reported to us within the warranty period. We reserve the right to request the return of defective parts.

If your kit was shipped by parcel post and is received in a damaged condition, please write us at once describing the state in which the shipment was received. If your kit was part of a Railway Express shipment that was damaged in transit, please notify the Railway Express agent at once and then write us.

The efficiently engineered KNIGHT kits are moderately priced. When you buy a KNIGHT kit you get the best in design, quality, and value. Recommend KNIGHT kits to your friends.

ALLIED'S SERVICE FACILITIES

If the kit does not operate properly, we recommend the following:

Please write our Kit Department giving the stock number and date of purchase of the kit. Also, describe fully what appears to be wrong. Details as to which controls or sections of the circuit do not function properly will help us analyze the problem. We may be able to determine a wiring error or a defective part.

This wired KNIGHT kit may be returned for inspection within one year after purchase for a special service charge of \$2.00. Parts within the standard RETMA 90-day warranty period will be replaced without charge for the parts. A charge will be made for parts damaged in construction or because of a wiring error, or for parts which are beyond the 90-day warranty period. After the one year period, service charges are based on the length of time required to repair the unit plus the cost of any new parts that may be needed.

PLEASE NOTE: KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX ARE NOT ELIGIBLE FOR REPAIR OR SERVICE AND WILL HAVE TO BE RETURNED NOT REPAIRED AT YOUR EXPENSE.

Allied's service facilities are primarily for inspection and trouble-shooting. Kits not completely wired, which require extensive work, will be returned collect with a letter of explanation.

If you return this kit, pack it well. To prevent damage in shipment, use a large enough carton so that cushioning material can be placed around the unit. Cushion it well and tightly. Mark the carton, "FRAGILE — DELICATE ELECTRONIC INSTRUMENT." Send the kit prepaid and insured. We will return the repaired kit to you C.O.D. as soon as repairs are completed. If you wish to save C.O.D. fees, your advance remittance may be enclosed to cover the standard repair charges plus transportation costs. Any excess money will be refunded.

Other Famous knight-kits For the **AMATEUR**

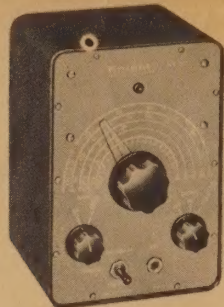


knight-kit
50-WATT TRANSMITTER
83YX255

Whether you're looking for a low-cost transmitter to put you "on-the-air"; or, a dependable stand-by rig—you'll do well to check through all of the many desirable features of the KNIGHT-KIT transmitter.

The KNIGHT-KIT transmitter is a complete, self-contained, bandswitching cw transmitter kit that can be operated crystal controlled or with external vfo.

With all parts, tubes, pre-cut wire, solder, and step-by-step instructions.



knight-kit
VFO
83Y725

The KNIGHT-KIT VFO offers high-quality performance at incomparably low cost. Look over its array of outstanding features and you'll see that it includes everything desirable in vfo design. It's a completed vfo with built-in transformer-type power supply. Features ex-

tremely high stability, excellent oscillator keying characteristic for fast break-in operation, highly effective tvf suppression, easy tuning and ultra-compact construction.

Exceptional frequency stability is assured by careful circuit design and rigid mechanical construction. Drift free, series-tuned Clapp oscillator employs 1% silver mica capacitors. Oscillator tank coil is wound on heavy ceramic form. Excellent voltage regulation maintains stable output, unaffected by changes in line voltage. Rugged mechanical construction—oscillator chassis is flange-welded for rigidity; bandswitch is heavy ceramic. Has Calibrate-Standby-Transmit switch for "no-swish" tuning. Extra switch contacts are connected to a terminal strip on rear of chassis for control of external equipment.

Complete with all parts, tubes, pre-cut wire, solder, and step-by-step instructions.

SPECIFICATIONS

Output Frequencies: 3.5 — 4 mc
7.0 — 7.3 mc
14.0 — 14.3 mc
21.0 — 21.5 mc
27.0 — 27.2 mc
28.0 — 29.7 mc

Power Input To Final

Amplifier: 50 watts minimum on all bands.

Frequency Control: Quartz crystal or external vfo.

Output Circuit: Pi-network, capable of matching unbalanced loads between 50 and 1200 ohms. Will tune out large amounts of reactance. Connection to the output is through an SO-239 type coaxial connector.

Tubes: 6AG7 crystal oscillator-multiplier (buffer-multiplier when vfo used), 807 power amplifier, 5U4G rectifier.

Modulation: Provision is made for the connection of an external modulator.

VFO Operation: The KNIGHT 50-Watt Amateur Transmitter may be controlled by any vfo supplying 8 to 10 volts across 22,000 ohms, and delivering output in the 160, 80, or 40 meter bands. The KNIGHT VFO is ideally suited.

TVI Reduction: The transmitter is completely shielded by its cabinet, with firm metal-to-metal seals provided at all metal junctions. The copper finished chassis is well bonded to both front and rear of the cabinet, thus assuring minimum harmonic radiation. Filtering and bypassing of AC and keying leads is provided, and generous bypassing of the meter and heater circuits is included.

Size: 10½ x 8½ x 8¼".

Shipping Weight: 18 lbs.

SPECIFICATIONS

Frequency Coverage: 80, 40, 20, 15, 11, and 10 meter bands.

RF Output: 40 volt output on 80 meters; 20 volt output on 40 meters. Dial calibrated on all bands.

Tubes: 6BH6 Clapp oscillator, 6BH6 buffer-doubler, 6X4 rectifier, and OA2 voltage regulator.

Power Source: 110 to 120 volts, 50 to 60 cycles.

Size: 8¾ x 6 x 6".

Shipping Weight: 8 lbs.